MUNICIPALITÉ DE
CASSELMAN
MUNICIPALITY

MUNICIPALITY OF CASSELMAN

CONTRACT FOR
Casselman Main Sewage Pumping Station Upgrade

ENPS1-01-2025
April 2025

JLR No. 16953-134

SECTION TITLE

PART A – FRONT END SPECIFICATIONS

DIVISION 00 INFORMATION FOR TENDERERS

PART B – TECHNICAL SPECIFICATIONS

DIVISION 01 GENENERAL REQUIREMENTS

DIVISION 02 SITEWORK

DIVISION 03 CONCRETE

DIVISION 06 WOOD AND PLASTICS

DIVISION 07 THERMAL AND MOISTURE PROTECTION

END OF SECTION

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C101	SITE PLAN
C102	FORCEMAIN PLAN & PROFILE BRISSON STREET
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END OF SECTION

PART A – FRONT END SPECIFICATIONS

1.1 DESCRIPTION OF THE WORK

.1 The full scope of work is prescribed in detail in the attached tender documents. Without limiting the specifics of these requirements, the work generally consists of:

- .1 Brisson Street Casselman Main SPS No.1 Upgrades:
  - .1 Removal of the asphalt roof shingles and new metal roof.
  - .2 Implementation of new roof penetrations for the new ventilation exhaust system.
  - .3 Construction of a new electrical room, including a new MCC, VFDs, unit heater, AC cooling system, and ventilation.
  - .4 Provision of new electrical equipment, PLC, ATS, pump starters, and instrumentation to serve the pumping station.
  - .5 Supply and installation of two new sewage pumps, intake piping and header.
  - .6 Construction of new equipment concrete pads and pipe supports.
  - .7 Removal and replacement of the screening screw washer compactor unit.
  - .8 Rehabilitation of the mechanical bar screen unit.
  - .9 Construction of a new emergency overflow sewer discharging to the South Nation River.
  - .10 Replace electric motors on existing pump.

- .2 Brisson Street, right-of-way easement, Laurier Street and Casselman Lagoon property:
  - .1 Coordination, supply, installation, and commissioning of a new forcemain parallel to the existing forcemain from the SPS site to the Lagoon property.
  - .2 Coordination, supply, installation, and commissioning of drain and air release chambers along new alignment.
  - .3 Coordination, supply, installation, and commissioning of alum injection manhole and upgrades to pumping equipment, supports and communications at the alum building.
  - .4 Coordinate, connection and modifications to the existing splitter box at Lagoon property.
  - .5 Modifications to the alum injection system at the Lagoon property consisting of:
  - .6 Topsoil and Vegetation removal, landscaping and application of topsoil and hydroseed to disturbed area, including around the pumping station building.
- .3 The Contract Time will be from June 1, 2025 and shall have the works Ready-For-Takeover by November 30, 2026.
- .4 No onsite work shall commence prior to receipt of the environmental compliance approval (ECA). The ECA for Sewage is anticipated by July 25, 2025

1.2 OWNER AND CONSULTANT

.1 **Owner:** Municipality of Casselman
751 St-Jean Street
Casselman, Ontario
K01 1M0

.2 **Consultant:** J.L. Richards & Associates Limited
343 Preston Street
Tower II, Suite 1000
Ottawa, Ontario
K1S 1N4

1.3 CONTRACT DOCUMENT IDENTIFICATION

.1 Contract / Bid Documents are identified as Project No. 16953-134, as prepared by J.L. Richards & Associates Limited, located at 1000-343 Preston Street, Ottawa, Ontario, K1S 1N4 and listed in Table of Contents.

1.4 DELIVERY OF TENDERS

.1 ELECTRONIC BID SUBMISSIONS ONLY, shall be receiving by the Bidding system. Hardcopy submissions not permitted.

.2 Bidders are cautioned that the timing of their Bid Submission is based on when the Bid is RECEIVED by the Bidding System, not when a Bid is submitted, as Bid transmission can be delayed due to file transfer size, transmission speed, etc.

.3 For the above reasons it is recommended that sufficient time to complete your Bid Submission and to resolve any issues that may arise. The closing time and date shall be determined by the Bidding System's web clock.

.4 Bidders should contact Bids & Tenders support listed below, at least twenty-four (24) hours prior to the closing time and date, if they encounter any problems. The Bidding System will send a confirmation email to the Bidder advising that their bid was submitted successfully. If you do not receive a confirmation email, contact Bids & Tenders support at support@bidsandtenders.ca. Late Bids are not permitted by the Bidding System.

.5 To ensure receipt of the latest information and updates via email regarding this bid, or if a Bidder has obtained this Bid Document from a third party, the onus is on the Bidder to create a Bidding System Vendor account and register as a Plan Taker for the bid opportunity.

1.5 DISQUALIFICATION OF TENDERS

.1 Under no circumstance will Tender be considered which are received after 3:00:00 p.m. on the advertised closing date of May 16, 2025 for Tenders.

1.6 WITHDRAWAL OR QUALIFYING OF TENDERS

.1 A Tenderer who has already submitted a Tender may submit a further Tender at any time up to the official closing time. The last Tender received shall supersede and invalidate all Tenders previously submitted by the Tenderer for this Contract.

1.7 INFORMAL OR UNBALANCED TENDERS

.1 Tenders that are incomplete, conditional, illegible or obscure, contain information not called for, reservations, erasures, alterations or irregularities of any kind may be rejected as informal.

.2 Tenders that contain prices which appear to be so unbalanced as to affect adversely the interests of the Owner or Tenders which are based upon an unreasonable period of time for the completion of the works may be rejected.

.3 The Owner reserves the right to waive any and all informalities, as the interests of the Owner may require, without stating the reasons therefore.

.4 Tenders that do not exhibit an adequate "Proof of Ability" may be rejected.

1.8 TENDER INCONSISTENCIES

.1 In any instances where the total of individual prices of the Tender does not equal the total Tendered Price, the mathematical summation of the constituent tendered prices will be taken as the offered Tender Price.

.2 If amount tendered for an item does not agree with the extension of the estimated quantity and the Tendered Unit Price, the Unit Price is to govern and the item amount and Tender Price will be corrected accordingly.

1.9 SITE ASSESSMENT

.1 The following non-mandatory site assessment has been scheduled:
Casselman Main SPS Site (located at 16 Brisson St. Casselman, ON): May 6, 2025 at 10:00AM.

.2 Each Bidder are to apprise themselves of the site before submitting their Tender and satisfy themselves by personal examination as to the local conditions affecting construction of the work.

.3 As Bidders have the opportunity to visit the site and make necessary examinations and investigations of the apparent and accessible conditions, the Successful Proponent shall not be entitled to subsequently claim any increase to the contract time or contract price resulting from any failure or omission to:

.1 identify otherwise reasonably apparent or accessible conditions;

.2 incorporate further investigative activities required into their proposal.

1.10 INQUIRIES AND ADDENDA

.1 If in doubt about meaning or intent of any part of Tender Documents, notify the Consultant and Municipality in writing. If no questions are received, it will be assumed that work is clearly defined, and that Bidders are in no doubt as to meaning or intent of the Tender Documents.

.1 Direct questions in writing via Bids And Tenders with attention to:

.1 Jordan Morrissette, P.Eng. at jmorrissette@jlrichards.ca; and

.2 Pierre-Paul Beauchamp, Director of Public Works at ppbeauchamp@casselman.ca

.2 Contractor inquiries may be issued up to five (5) business days prior to bid close.

.3 Consultant replies to inquiries will be in the form of an addendum and will be uploaded to the website no later than two (2) business days before bid close.

.4 The Consultant and Owner will not provide oral responses to inquiries. The tender documents cannot be modified via oral response.

1.11 BID SECURITIES

.1 Security Deposit:

.1 Bids are to be accompanied by a security deposit in the form of a Bid Bond from a surety company licensed to carry on business in the Province of Ontario in amount of 10% of the bid price.

.2 Endorse Bid Bond in name of Owner as obligee, signed and sealed by principal (Contractor) and

surety or certified cheque payable to the Owner.

.3 Use bond forms in compliance with the Ontario Construction Act.

.4 Security deposit will be retained without interest by Owner until the following, whichever occurs first:

.1 A Contract is entered into and, after delivery to Owner of required Performance and Labour and Materials Payment Bond(s) by accepted Bidder, or sixty (60) days after Tender Closing.

.2 If no contract is awarded, security deposits will be returned.

.5 Each Bidder understands and agrees that, if their Tender is withdrawn before Owner considers Tenders, or before he has been notified that their Tender has been accepted by Owner, or if they fail for any reason to execute an Agreement and provide other documents as specified herein, the Owner may retain their security deposit for the Owner's use.

.2 Consent of Surety/Agreement to Bond:

.1 Tender submission must include a clear and unqualified commitment from a surety company licensed to carry on business in the Province of Ontario, to provide Labour and Material Payment and Performance Bonds, in a format acceptable to the Owner, if the Bidder is successful in his Tender to the Owner.

.1 Alternatively, the Consent of Surety/Agreement to Bond may be a letter from a financial institution licensed to carry on business in the Province of Ontario, advising they will provide a certified cheque or a clear and unqualified Irrevocable Letter of Credit to the Owner, in a format acceptable to the Owner, if the Bidder is successful in his Tender to the Owner.

.3 Include all associated costs of bonds, or certified cheque, or Irrevocable Letter of Credit in the Bid Price.

.4 If no contract is awarded, all security deposits will be returned.

.5 Required Bonds:

.1 The following Bonds are required to be provided by the successful Bidder following execution of the Agreement.

.1 Labour and Material Payment Bond in the amount of 50% of the contract value.

.2 Performance Bond in the amount of 50% of the contract value.

.6 Insurance:

.1 Provide a signed "Undertaking of Insurance" on a standard form provided or as provided by the Insurance Company stating their intention to provide insurance as identified in Section 00800 Supplementary Conditions.

.2 Include the cost of insurance in the Bid Price.

.7 Submit a valid Workplace Safety and Insurance Board Clearance Certificate.

1.12 CONTRACT AGREEMENT

.1 Agreement Form:

.1 The Owner/Contractor contract will be the CCDC 2 2020 Edition.

1.13 SUBSTITUTION AND ACCEPTANCE OF ALTERNATE PRODUCTS

.1 Refer to Section 01250 Substitution Procedures.

1.14 LOCAL TRADES, LABOUR AND SUPPLIERS

.1 Contractor and / or Subcontractors are encouraged to contract and employ local trades people, suppliers, labourers, machine operators and equipment in the construction of this facility and to purchase from local suppliers.

.2 Responsibility for the Work, construction schedule and supply of materials in employing local labourers, trades people, machine operators, equipment, suppliers, etc., remain solely with the Contractor.

1.15 OFFER ACCEPTANCE / REJECTION

.1 The Consultant, on behalf of the Owner, will issue to the successful Bidder a written letter of intent indicating that the Owner will enter into a CCDC 2 2020 Stipulated Price Contract with the Contractor.

.2 A bid is conditionally accepted by the Owner upon issuance of letter of intent.

.3 The acceptance of a bid is subject to the condition that the Owner receive a Performance Bond and a Labour and Material Payment Bond, as required herein, and in a form satisfactory to the Owner, within seven (7) working days after notification of contract award.

.4 The Consultant does not have the authority to make or accept an offer or to enter into a Contract on behalf of the Owner.

.5 The Consultant recommendation of a bid to the Owner for acceptance does not constitute acceptance of the bid by the Owner.

.6 The Owner will not be responsible for any liabilities, costs, expenses, loss or damage incurred, sustained or suffered by any Bidder prior to, subsequent to, or by reason of the acceptance or the non-acceptance by the Owner of any bid, or by reason of any delay in the acceptance of a Tender save as provided in the Contract.

.7 The Owner reserves the right to reject any or all bids without stating reasons.

.8 The Owner reserves the right to reject any or all bids if the project is not approved by Council.

.9 The Owner shall have the right to waive nonmaterial irregularities in a tender.

.10 The Owner reserves the right not to accept bids if two (2) or less bids are submitted.

1.16 IRREVOCABILITY OF BID

.1 The Bidder is to hold in force and may not revoke their bid for a period of sixty (60) calendar days following the Bid Opening.

.2 If the Bidder revokes their offer within this period, the Bidder will forfeit their Bid Security. This does not prohibit the Owner from pursuing other legal means for damages.

1.17 PROOF OF ABILITY

.1 The Bidder shall be competent and capable of performing the Work. The Bidder will be rated by the Owner and Consultant based on the Form of Tender provided. The Bidder will complete the following statement sheets to provide the Owner and Consultant a basis for rating of Bidders:

.1 Statement 'A' - Giving a list of the Tenderer's senior supervisory staff to be employed on the Contract with a summary of the experience of each.

.2 Statement 'B' - Giving the location and description of the construction equipment which the Tenderer proposes to use.

.3 Statement ‘C’ - Giving the list of proposed subcontractors.

.4 Statement ‘D’ - Giving a breakdown of items and prices.

.5 Statement ‘E’ - Giving the contact information for each Tenderer.

.6 Statement ‘F’ - Providing declaration of accessibility compliance per Town’s standard.

.2 The Tenderer may, if prefers, in lieu of completing and submitting the above-mentioned statement sheets, submit the information required by the said sheets on similar forms prepared in the Tenderer’s own office, provided that the said forms bear the Tenderer's name and the date of preparation and contain up-to-date information.

END OF SECTION

TENDERER'S CHECK SHEET

Tenderer is to complete and submit this Check Sheet with its Tender.

Before submitting your Tender, check the following points (which is a non-exhaustive list):

Is your tender in ink or typed?..... ☐

Is your tender complete? ..... ☐

Is your tender irrevocable for sixty (60) days?..... ☐

Has your tender been signed and your seal affixed? ..... ☐

Have you enclosed the required Security? ..... ☐

Have you enclosed the required Agreement to Bond signed and sealed by your proposed surety?..... ☐

Have you completed and included the Statutory Declaration Form?..... ☐

Have you completed and included Statements A, B, C, D, E, F? ……..... ☐

Have you acknowledged the number of Addenda received where required to do so, and where appropriate, including the information included in Addenda in your total Tender Price? ..... ☐

Have you initialed erasures, overwriting or strikeouts, if any? ..... ☐

Confirm that your tender is not made conditional by a statement added to the Tender Form or by a covering letter, by checking this box: ..... ☐

Confirm that you were able to access and download the following files from Bids & Tenders website as it relates to this Tender:

Drawings ……..... ☐
Specifications ……..... ☐

Checklist Form (to be completed by Tenderer)

COMPANY: _____

NAME: _____

TITLE: _____

SIGNATURE: _____

DATE: _____

MUNICIPALITY OF CASSELMAN

CASSELMAN MAIN SEWAGE PUMPING STATION UPGRADES

From: .....

.....

.....

.....

(Name and Address of Tenderer)

To: Municipality of Casselman

751 St-Jean Street

Casselman, Ontario

K0A 1M0

Attention: Pierre-Paul Beauchamp, Director of Public Works

1. I/We, the undersigned, hereby offer and agree to furnish all required labour, materials, equipment and supervision and to execute the work set out in the Tender Documents, including all Addenda, and including all fees, permits, and taxes, but excluding HST, for the Stipulated Price of the core bid. (This number shall match line A in Schedule 1 – Schedule of Items and Prices).

.....

..... DOLLARS $(.....)

2. .1 I/We acknowledge receipt of and have included for in our Stipulated Price the requirements of the following Addenda:

Addendum No. .....dated .....

Addendum No. .....dated .....

Addendum No. .....dated .....

Addendum No. .....dated .....

Addendum No. .....dated .....

Addendum No. .....dated .....

Addendum No. .....dated .....

Addendum No. .....dated .....

.2 I/We have included for in our Stipulated Price the following Allowances as set out in the Schedule of Items and Prices and Opinion of Probable Costs.

.1 Cash Allowance for work resulting from the Designated Substances Survey.
.2 Cash Allowance for Owner's Independent third-party Geotechnical Engineer.
.3 Cash Allowance for materials testing.
.4 Cash Allowance for Owner's Independent third-party Archaeologist.
.5 Hydro Ottawa Allowance.
.6 Contingency Allowance.

3. .1 I/We declare that this Tender is made without knowledge, comparison of figures or arrangement with any other Company, Firm or Person making a Tender for this same work and that no officer or employee of the Owner has any direct or indirect interest in the performance or work of this Contract.

.2 I/We further declare that no member of the Municipal Council and no officer or employee of the Ministry or of the Crown or of the Consultant is or will become interested directly or indirectly as a contracting party, partner, surety or otherwise in or in the performance of the Contract or in the supplies, work or business to which it relates, or in any portion of the profits thereof, or in any of the monies to be derived therefrom.

.3 I/We recognize the right of the Owner to reject any or all Tenders and to waive informalities as the interests of the Owner may require.

.4 I/We have visited and carefully examined the site of the work and have satisfied and informed myself/ourselves as to all the existing conditions, limitations and difficulties which may arise and govern the completion of the work.

4. I/We agree that, if this Tender is accepted by the Owner,

1) I/We will carry out any additional or extra work (including the supplying of any additional materials or equipment pertaining thereto) or will delete any work as may be required by the Owner in accordance with the Contract;

2) the carrying out of any work referred to in paragraph 1) above or the issuance by the Owner of a Contract Change Order relating to such work or the acceptance by the Tenderer of such Contract Change Order shall not, except as expressly stated in such Contract Change Order, waive or impair any of the terms of the Contract or of any Contract Change Order previously issued by the Owner or any of the rights of the Owner or of the Consultant under the Contract;

3) I/We will pay to the Owner the sum specified in the Contract as liquidated damages for each calendar day that the work under the Contract as expressly modified by all Contract Change Orders issued by the Owner remains uncompleted after the expiry of the Time for Completion specified in the Contract or the extended time for completion allowed in writing by the Owner.

The prices applicable to work referred to in paragraph 1) above shall be determined as follows:

(a) The Schedule of Items and Prices shall apply where applicable.

(b) If the above Schedule is inapplicable the prices shall be determined in accordance with the General Conditions.

I/We agree that we are not entitled to payment of the Contingency Allowance except for additional work carried out in accordance with the Contract and only to the extent of such additional work, as authorized by the Owner in writing.

5. .1 I/We include herewith the following documents:

.1 I/We agree to furnish to the Owner copies of all required Subcontractor Performance Bonds and Labour and Material Payments Bonds forthwith upon execution of subcontracts with our Owner-approved subcontractors and further agrees that no payment will be due and payable for work done by any subcontractor whose work is required to be bonded until such time as the required bonds have been filed with the Owner.

.2 I/We agree that, if so requested in writing by the Owner, we will enter into a Contract with the Owner based upon our Tender but jointly in the names of the Tenderer and the Tenderer's parent company, if any. I/We further agree that any request by the Owner as indicated above is not and shall not be deemed to be a counteroffer by the Owner.

.3 A Bid Bond or Certified Cheque in the amount of 10% of the Bid made payable to the Owner. I/We understand that this Bid Security will be returned to me/us following the award of a Contract, if this Tender is not accepted by the Owner, or, if this Tender is accepted by the Owner, following my/our execution of the Agreement.

.4 An Agreement to Bond from an approved surety company licensed to carry on business in the Province of Ontario.

.2 I/We agree to submit a List of Proposed Subcontractors (Statement ‘C’), as specified, within 24 hours of Tender closing.

6. .1 I/We agree to hold this Tender in full force and effect for a period of 60 days from the closing date for Tenders and agree that if my/our Tender is revoked during this period, my/our Bid Security will be forfeited to the Owner to use for his purposes.

.2 I/We agree, if this Tender is accepted, to execute the specified Agreement and provide the specified Bonds within ten (10) days of notification by the Owner to do so.

.3 I/We agree that within seven (7) days after written authorization from the Consultant to proceed, I/We will commence the work, assembling all necessary labour forces and equipment on the site, and will continue the work with the utmost diligence until completion.

I/We agree to have the works "Ready-For-Takeover" by November 30, 2026, based on an award date that is no later than June 2, 2025. Should the award be issued following June 2, 2025, the date of Ready-For-Takeover shall be extended by the same number of days.

I/We agree that we will furnish the Owner a copy of the latest financial statement within 4 days after being requested to do so by the Owner.

The “Agreement to Bond” of the ....., a company lawfully doing business in the Province of Ontario, to furnish a performance bond and a labour and material payment bond in the form acceptable to the Owner Performance Bond and Labour and Material Payment Bond each in an amount equal to 50% of the Contract price, or in such greater amount as may be required by the Owner, if this Tender is accepted, is enclosed herewith.

Dated at ..... this ..... day of

....., 20....

....

....
Signature of Witness Signature of Tenderer

Note: If the Tender is submitted by or on behalf of a corporation, it must be signed in the name of such corporation by the duly authorized officers and the seal of the corporation, or wafer seal, must be affixed. If the Tender is submitted by or on behalf of an individual or a partnership a seal must be affixed opposite the signature of the individual or of each partner and each signature shall be witnessed.

Signed, sealed and submitted on behalf of:

.....

.....

.....

.....
(Name and Address of Tenderer)

.....
(Signature of Tenderer)

.....
(Name and Title) Corporate Seal

.....
(Signature of Witness)

Dated at ....., ... this ..... day of .....20...
(Town/City) (Province)

SCHEDULE 1

SCHEDULE OF ITEMS AND PRICES

Item	Description	Amount
1.	Mobilization and demobilization at the job including temporary offices and conveniences, other temporary facilities, hoarding, reinstatement and other items not required to form part of the permanent works (60% to be paid upon complete mobilization and 40% to be paid upon complete demobilization).	$.....
2.	Lump Sum for the upgrades, excluding Items 1 and Items 3 to 14. All Tenderers will be requested to submit a breakdown of this item as per the attached Breakdown of Items and Prices Table 1 per the Instructions to Bidders.	$.....
3.	Bonding per Instructions to Bidders.	$.....
4.	Insurance per Instructions to Bidders.	$.....
5.	Capital Controls – Instrumentation and Controls System Integrator for the Brisson Street Main Sewage Pumping Station Upgrades	$.....
6.	Veolia – Repair work for the Contflo Mechanical bar screen repair work	$.....
7.	Veolia – Replacement of the RPW Rotopac compactor	$.....
8.	Rock Removal (per Section 02160) for 810 m^3	$.....
9.	Cash allowance for materials testing.	$ 25,000.00
10.	Cash allowance for Owner's Third-Party Archaeologist	$ 30,000.00
11.	Cash allowance for Owner's Third-Party Geotechnical Engineer	$ 25,000.00
12.	Hydro Ottawa Allowance	$ 30,000.00
13.	Allowance for Remediation Work Resulting from Designated Substances	$ 10,000.00
14.	Contingency allowance	$ 500,000.00
	(A) Total stipulated lump sum (total of Items 1 to 14) – Core Bid	**$.....**
	(B) HST (13%)	**$.....**
	(C) Total Price Including HST	**$.....**

AGREEMENT TO BOND

**……..……..

……..……..

Date: ..... 20....

Municipality of Casselman
751 St-Jean Street
Casselman, Ontario
K0A 1M0

Dear Sirs and Madams:

Re: Construction of the Casselman Main Sewage Pumping Station Upgrades

In consideration of the Municipality of Casselman (hereinafter referred to as "the Owner") accepting the Tender of and executing and Agreement with: .....(hereinafter referred to as "the Tenderer") for the construction of: Casselman Main Sewage Pumping Station Upgrades subject to the express conditions that the Owner receive the Performance Bond and the Labour and Material Payment Bond in accordance with the said Tender, we the undersigned hereby agree with the Owner to become bound to the Owner as surety for the Tenderer in a Performance Bond and a Labour and Material Payment Bond each in an amount equal to 50% of the Contract price or other such greater amount as may be determined by the Owner, in the forms of Performance Bond and Labour and Material Payment Bond and in accordance with the said Tender, and we agree to furnish the Owner with said Bonds within ten (10) days after notification of the acceptance of the said Tender and execution of the said Agreement by the Owner has been mailed to us.

Yours very truly,

.....

(Seal)

NOTE: This Agreement to Bond must be executed on behalf of the Surety Company by its authorized officers under the company's corporate seal. Of the two forms bound herein, one shall become a part of the Tender and the other shall be retained by the Surety Company.

** **Enter the name and address of the Surety Company at the top of the page.**

STATUTORY DECLARATION RE: TENDER

JLR PROJECT NO. 16953-134

DOMINION OF CANADA

IN THE MATTER of a Proposed Contract
for the Construction of:
Municipality of Casselman
Casselman Main Sewage Pumping Station Upgrades
in the ***Municipality of Casselman***
in the Province of Ontario.

TO WIT

..... DO SOLEMNLY SWEAR THAT the several matters stated in the foregoing Tender are in all respects true, AND ..... make this solemn declaration, conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath, and by virtue of "The Canada Evidence Act".

DECLARED before me at

the .....)
.....)
.....)
of .....)
in the County of .....)
.....)
this ....., day of)
.....20 ….)

.....
Tenderer

.....
Commissioner, etc., (or Notary Public)

Section 2 of the General Conditions requires that the Tenderer complete and submit this declaration with his Tender. Failure of the Tenderer to include the properly completed Statutory Declaration with his Tender may result in the Tender being ruled invalid by the Owner.

STATEMENT 'A'

QUALIFICATIONS OF TENDERER'S SENIOR SUPERVISORY STAFF TO BE EMPLOYED ON THIS CONTRACT.

Name	Appointment	Qualifications and Experience
General Contractor's Project Manager		
General Contractor's Site Foreman		
Mechanical Contractor's Project Manager		
Mechanical Contractor's Site Foreman		
Electrical Contractor's Project Manager		
Electrical Contractor's Site Foreman		
Civil Contractor's Project Manager		
Civil Contractor's Site Foreman		
Systems Integrator's Project Manager		
Systems Integrator's Site Foreman		
Commissioning Agent		

STATEMENT 'B'

PROPOSED MAJOR CONSTRUCTION EQUIPMENT TO BE UTILIZED ON THIS CONTRACT.

EQUIPMENT/AVAILABLE: .....

.....

.....

.....

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.....

.....

EQUIPMENT/TO BE RENTED: .....

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.....

.....

EQUIPMENT/TO BE PURCHASED: .....

.....

.....

.....

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STATEMENT 'C'

LIST OF PROPOSED SUBCONTRACTORS

The information for Tenderers requires the Tenderer to list on this Statement Sheet the name of each proposed subcontractor. For the Tenderer's convenience and to ensure that a complete list is submitted with the Tender, a list of possible subtrades has been printed below. The Tenderer shall make an entry against each possible subtrade listed either by naming the proposed subcontractor or by entering "by own forces", whichever applies. No blank spaces are to be left.

If, in addition, the Tenderer proposed to sublet a part of the work which is not listed below, the Tenderer shall add the subtrade and the proposed subcontractor's name to the list.

FAILURE BY A TENDERER TO COMPLY WITH THE FOREGOING REQUIREMENTS MAY RESULT IN THE TENDER BEING DISQUALIFIED BY THE OWNER.

SUBTRADE SUBCONTRACTORS	PROPOSED (1)	VALUE OF SUBCONTRACT (2)
Concrete		
Civil		
Mechanical		
Electrical		
Instrumentation		
Precast Concrete Enclosure		
Wet Well Insert		
By-Pass Pumping System		
Other	Veolia	
Other	Capital Controls	

(1) Enter full legal name of subcontractor.
(2) Value of Subcontract entered shall be for the core bid only.

STATEMENT 'D'

BREAKDOWN OF ITEMS AND PRICES

The following detailed breakdown of items and prices will be submitted in accordance with the Instructions to Bidders. A further possible breakdown of these items will be determined with the successful Contractor after execution of the Contract for the purpose of progress payment certificates.

The Total at the end of Table 1 should equal Item 2 (in Schedule 1) for the Casselman Main Sewage Pumping Station Upgrade and all associated works as identified in Schedule of Items and Prices in Form of Tender. All provisional items shall be excluded.

Table 1 – Breakdown of Items for the Casselman Main SPS Upgrades

Item	Description	Amount
1	Division 01 - General Requirements	
1.1	All general requirements	
1.2	Other	
2	Division 02 - Sitework	
2.1	Field office for contract administrator	
2.2	Plans and submittals	
2.3	Management of excess soils	
2.4	Rock excavation for forcemain installation	
2.5	Earth excavation	
2.6	All forcemain, gravity sewers, and maintenance chambers	
2.7	Landscaping	
2.8	Road works	
2.9	Other civil works	
3	Division 3 - Concrete	
3.1	Pumping station equipment pad	
3.2	Minor concrete removals	
3.3	Other	
4	Division 4 - Masonry	
4.1	Other	
5	Division 5 - Metals	
5.1	Partition metal stud framing	
5.2	Other	
6	Division 6 - Wood and Plastics	
6.1	All wood and plastics	
6.2	Other	
7	Division 7 - Thermal and Moisture Protection	
7.1	All pumping station thermal and moisture protection	
7.2	Sealants and firestopping	
7.3	Other	
8	Division 8 - Doors and Windows	
8.1	All pumping station doors and windows	
8.2	Hardware	

8.3	Other	
9	Division 9 - Finishes	
9.1	All pumping station finishes	
9.2	Other	
10	Division 10 - Specialties	
10.1	Other	
11	Division 11 – Equipment (Supply and Install)	
11.1	Sewage pumps	
11.3	Screen repair	
11.4	Compactor	
11.5	Shower enclosure base	
11.6	Washroom accessories	
11.7	Other	
12	Division 12 - Furnishings	
12.1	Other	
14	Division 14 - Conveying Systems	
14.1	Other	
15A	Division 15A - Process Mechanical	
15A.1	Miscellaneous removals	
15A.2	All pumping station piping and appurtenances	
15A.4	Other	
15B	Division 15B - Building Mechanical	
15B.1	Pumping station ventilation and cooling	
15B.2	Pumping station heating	
15B.3	Plumbing	
15B.4	Other	
16	Division 16 - Electrical	
16.1	Miscellaneous removals	
16.2	Variable frequency drive panels	
16.3	All other electrical appurtenances	
16.4	Other	
17	Division 17 - Instrumentation and Controls	
17.1	Pumping station PLC panel and enclosure	
17.2	Alum Building PLC panel upgrades	
17.3	System integration	
17.4	All other instrumentation and controls	
17.5	Other	
	TOTAL	

STATEMENT 'E'

RESPONDENT IDENTIFICATION

RESPONDENT:

_____
Company Name

_____
Address

_____

_____

_____
Telephone Number

_____
Fax Number

_____
Email Address

_____
Name of Person Signing

_____
Position of Person Signing

_____
Signature

Person signing must be authorized to sign on behalf of the Company/Individual represented, and to bind the Company/Individual to statements made in response to this Contract.

STATEMENT 'F'

DECLARATION OF ACCESSIBLITY COMPLIANCE

COMPANY NAME:	
PRINT NAME:	
TITLE:	**DATED:**

I/We acknowledge that as a Contractor/Consultant of the Municipality of Casselman, we are bound to comply with all accessibility Standards under the Accessibility for Ontarians with Disabilities Act, 2005 as amended from time to time.

I/We declare that I/We have read, understand and will meet or exceed all enacted accessibility Standards as amended from time to time.

I/We further declare that I/we will undertake to ensure all subcontractors hired by us in completion of our work will also comply with the above Standards.

_____ _____

Authorized Signature **Dated**

_____

Printed Name

1.1 CONTRACT

.1 The Form of Agreement that the successful Tenderer, as the Contractor, will be required to execute is Standard Construction Document CCDC 2, Stipulated Price Contract, 2020.

1.2 GENERAL CONDITIONS

.1 General Conditions (GC) of Standard Construction Document, CCDC 2, Stipulated Price Contract, 2022, Parts 1 to 13 inclusive, govern the work of this Contract and are hereby made a part of these Documents to same extent, as if bound herein.

.2 Refer to Supplementary Conditions bound herein for any amendments to General Conditions.

END OF SECTION

1.1 AMENDMENTS

.1 The General Conditions of Contract, as outlined in CCDC2 2020, are amended as noted hereafter.

.2 The Standard Construction Document for Stipulated Price Contract, CCDC2 2020 English version, consisting of the Agreement between Owner and Contractor, Definitions, and General Conditions of the Stipulated Price Contract, Parts 1 to 13 inclusive, governing same is hereby made part of these Contract Documents, with the following amendments, additions and modifications. Where these amendments, additions, and modifications specifically reference a change to the Agreement, Definitions, or General Conditions, these amendments, additions and modifications shall govern.

.3 Where a General Condition or a paragraph of the General Conditions of the Stipulated Price Contract is deleted by these Supplementary Conditions, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, and the numbering of the deleted item will be retained, unused.

1.2 ARTICLE A-6 – RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

.1 Delete and replace Article A-6.1 with the following:

"6.1 Notices in Writing between the parties or between them and the Consultant shall be considered to have been received by the addressee on the date of delivery if delivered by hand, email, or by commercial courier, or if sent during normal business hours by fax and addressed as set out below. Such Notices in Writing will be deemed to be received by the addressee on the next Working Day if received (by Consultant) by fax or email after 3:59pm of any day or if sent by overnight commercial courier. Such Notices in Writing will be deemed to be received by the addressee on the fifth Working Day following the date of mailing, if sent by pre-paid registered post, when addressed as set out below. An address for a party may be changed by Notice in Writing to the other party setting out the new address in accordance with this Article."

1.3 DEFINITIONS

.1 Add the following new definitions:

"27. "Submittals"

Submittals are documents or items required by the Contract Documents to be provided by the Contractor, such as:

- Shop Drawings, samples, models, mock-ups to indicate details or characteristics, before the portion of the Work that they represent can be incorporated into the Work; and
- As constructed drawings and manuals to provide instructions to the operation and maintenance of the Work.
- All other items identified within the Contract Documents to be submitted by the Contractor.

28. "Proper Invoice"

Proper invoice means a written bill or other request for payment for services and/or materials comprising the work performed under the Contract issued by the Contractor which document shall include the following:

.1 All information and requirements set out in section 6.1 of the Construction Act, which for the sake of clarity and certainty includes the following: The Contractor's name and address;

.2 The date of the “Proper Invoice” and the period during which the services and/or materials were supplied;

.3 Information identifying the authority, whether in the Contract or otherwise, under which the services or materials were supplied;

.4 A description, including quantity where appropriate, of the services or materials that were supplied;

.5 The amount payable for the services or materials that were supplied, and the payment terms;

.6 The name, title, telephone number and mailing address of the person to whom payment is to be sent;

.7 Any other information that may be prescribed by the Construction Act and any regulation thereto.

29. “Application for Progress Payment”

Application for Progress Payment shall mean the delivery of a “Proper Invoice”.

30. “Adjudication”

Adjudication shall have the meaning as set out in Part II.1 of the Construction Act.

31. “Construction Act or Act”

Construction Act or Act shall mean the Construction Act, R.S.O. 1990, c. C.30, as amended and its regulations thereunder as may be amended from time to time.”

1.4 GC1.1 - CONTRACT DOCUMENTS

.1 Add the following to the end of subparagraph 1.1.9:

“No claims will be considered or accepted relating to the disputes between the Contractor and/or Subcontractors regarding responsibilities of the *Subcontractors* for the completion of the divisions of work, including tie-in of the work between different trades, spatial interferences, cutting and patching and the like.”

1.5 GC 2.2 - ROLE OF THE CONSULTANT

.1 Add the word “schedules” after the word “techniques” in paragraph 2.2.5.

.2 Add to the end of the second sentence of paragraph 2.2.5:

“or to adhere to the construction schedule.”

1.6 GC 2.3 - REVIEW AND INSPECTION OF THE WORK

.1 Add the following to the end of paragraph 2.3.2:

“2.3.2 Should a designated test or inspection fail, the Contractor shall promptly correct and retest the work within 5 Working Days of the failed test or inspection using the designated testing/inspection agency. The Contractor shall be responsible for all costs associated with retesting or reinspection.”

.2 Add the following new paragraph 2.3.8:

"2.3.8 Notwithstanding the conduct of periodic reviews of the work in progress by the Consultant, the purpose of which is solely to determine general conformance with the requirements of the Contract Documents, the Contractor remains solely and exclusively responsible and liable for the means, methods, techniques, sequences and procedures for the completion of the Work and in connection with construction Safety at the Place of the Work."

1.7 GC 2.4 - DEFECTIVE WORK

.1 Replace the period "." at the end of paragraph 2.4.1 with a colon ":" and add new sub-sentences .1 and .2

"2.4.1.1 The Contractor shall correct, in a manner acceptable to the Owner and the Consultant, all defective work and deficiencies in the Work, whether or not they have been identified by the Consultant."

"2.4.1.2 The Contractor shall prioritize the correction of any defective work or deficiencies in the Work which, in the sole discretion of the *Owner*, adversely affects the day to day operation of the Owner."

1.8 GC 3.1 - CONTROL OF WORK

.1 Add the word "schedules" after the word "techniques" in paragraph 3.1.2.

.2 Add new paragraph 3.1.3:

"3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the Contractor shall verify, at the Place of the Work, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the Work and shall further carefully compare such field measurements and conditions with the requirements of the Contract Documents. Where dimensions are not included or exact locations are not apparent, the Contractor shall immediately notify the Consultant in writing and obtain written instructions from the Consultant before proceeding with any part of the affected work."

1.9 GC 3.4 - CONSTRUCTION SCHEDULE

.1 Delete sub-sentence .1 of paragraph 3.5.1 and replace with the following:

".1 Prepare and submit to the Owner and the Consultant prior to the first application for payment, a construction schedule that indicates the timing of major activities of the Work, including items called for under GC 4.1 – CASH ALLOWANCES and the timing of when Owner purchased items are required to be delivered to the Place of the Work for installation or hook-up by the Contractor, and provides sufficient details of the critical events and their inter-relationship to demonstrate that the work will be performed in conformity with the Contract Time."

.2 Add new sub-sentence .4 to paragraph 3.5.1:

".4 Commence the Work immediately upon award of the Contract and provide sufficient labour for the steady progress of the Work including overtime work, if required to meet the scheduled date of completion."

1.10 GC 3.5 - SUPERVISION

.1 Delete the period "." at the at the end of paragraph 3.5.1 and add:

"and not without prior consultation and agreement by the Consultant and Owner, which agreement shall not be unreasonably withheld."

1.11 GC 3.6 - SUBCONTRACTORS AND SUPPLIERS

.1 Amend paragraph 3.6.2 as follows:

.1 After the word "indicate" in the first line delete the words "in writing, if requested by the Owner", and add the words "on the applicable 'Bid Supplementary Form' form".

.2 Add the following sentence to the end of the paragraph: "The Contractor agrees not to change subcontractors and/or suppliers without the prior written consent of the Owner and the Consultant, which consent shall not be unreasonably withheld."

.2 Delete the words "through the Consultant" in paragraph 3.6.6.

1.12 GC 3.7 - LABOUR AND PRODUCTS

.1 Add new paragraph 3.7.4:

"3.7.4 The Contractor is responsible for the safe on-site storage of Products and their protection (including Products supplied by the *Owner* and Other Contractors to be installed as part of the Work). The Contractor is responsible to store and secure the Products in a location and in such ways as to avoid dangerous conditions or contamination of the Products and so as to avoid injury, damage or contamination of persons or property at the Place of the Work to the satisfaction of the Owner and the Consultant. The Owner shall provide all relevant information on the Products to be supplied by the Owner."

.2 Add new paragraph 3.7.5:

"3.7.5 Whenever more than one Product is specified for one use, the Contractor may select for this use any of the Products so specified unless the Specifications or the Drawings indicate otherwise."

1.13 GC 3.8 - SHOP DRAWINGS

.1 Add the words "AND OTHER SUBMITTALS" to the Title after SHOP DRAWINGS.

.2 Add "and Submittals" after the words "Shop Drawings" in paragraphs 3.8.1, 3.8.2, 3.8.3, 3.8.3.2, 3.8.5, 3.8.6, and 3.8.7.

1.14 GC 5.3 – PAYMENT

.1 Add new paragraph 5.3.2 as follows:

"5.3.2 In the event a construction lien is registered against the Place of the Work in circumstances where the Owner is not in breach of its payment obligations under this Contract, then the Contractor shall, within seven (7) days of receiving notice of the construction lien, have the lien removed by way of discharge, settlement, or posting security to vacate the registration of the lien. In the event that the Contractor fails to take the necessary steps to have the construction lien removed from title then, without prejudice to any other right or remedy it

may have, the Owner may see to the removal of the construction lien by payment into court or otherwise and the costs of so doing shall be to the Contractor's account."

.2 Add new paragraph 5.3.3 as follows:

"5.3.3 All progress payments are not conclusive as to the value or quality of services provided and are subject to further evaluation and readjustment on future and final progress payments. The submission of monthly applications for progress payments by the Contractor and Subcontractors must reflect accurate valuations for work completed and installed. The Contractor shall review and evaluate all Subcontractors work and be responsible for verifying the monthly applications for progress payments claimed."

1.15 GC 6.2 CHANGE ORDER

.1 Add new paragraph 6.2.3:

"6.2.3 All written descriptions or quotations submitted to support a proposed change to the Work and Change Orders must include all associated adjustments to the Contract Time and shall not be qualified as subject to future discussion or determination. All approved Change Orders must account for all prior and current adjustments to the Contract Time. Change Orders approved without indication of a change to the Contract Time will be deemed to have no impact to the Contract Time and may not be contested after execution."

.2 Add new paragraph 6.2.4:

"6.2.4 The foregoing GC 6.2.3 shall not prevent the Contractor from submitting a claim for cumulative time impact associated with multiple changes. If the Contractor can demonstrate that the cumulative impact of multiple individual Change Orders has or will result in a real and material change to the Work or Contract Time which cannot reasonably be mitigated and the claim can be supported with clear supporting documentation of the impact, then the Contractor is entitled to submit a proposed change to the Work pursuant to GC 6.2.1."

.3 Add new paragraph 6.2.5:

"6.2.5 The adjustment in the Contract Price for a change carried out by way of a Change Order or a Change Directive as provided in GC 6.2 CHANGE ORDER and CG 6.3 CHANGE DIRECTIVE, shall be determined in accordance with the following calculations, rates, conditions, and terms:

.1 All labour, equipment, rental of equipment or tools, materials, subcontracts and outside services to be charged as a result of changes to the scope of the Work will be subject to prior authorization by the Owner.

.2 The Owner will reimburse the Contractor for "Field Labour Costs" as the actual direct wages or salaries of the workers, up to and including working foremen, plus actual Payroll Burdens (see below). The foregoing shall not include additional costs for a full time site superintendent unless it is clearly demonstrated that additional time is required because of a contemplated extension to the Contract Time.

.3 "Payroll Burden" means the payments in respect of workers compensation insurance, vacation pay, unemployment insurance, public liability, and property damage insurance, sickness and accident insurance, pension fund and such other welfare and benefit payments as form part of the Contractor's normal base labour costs and may also include any applicable required cost or expense which has been incurred by the Contractor for food, lodging and similar items.

.4 The Contractor will provide the Owner with the information required to calculate Field Labour Costs within 14 days of commencement of the Contract.

.5 Field Labour Costs for premium portion overtime will be fixed and remain firm for the duration of this Contract and will not be subject to escalation unless prior written approval is obtained from the Owner, and such approval will not be unreasonably withheld.

.6 Only labour personnel up to and including working foremen will be chargeable on additional work and then only to the extent such personnel are directly engaged on the additional work. The Owner will not pay for supervision beyond the working foreman level, nor will it pay for administration or management time spent on additional work.

.7 The Owner will pay the Contractor for only for the cost of materials installed or used directly in connection with the Work (excepting materials supplied by the Owner) which are supported by invoices from delivery companies or transporters delivered with the Contractor's billing.

.8 The Owner will pay for the cost of rentals at the Place of the Work which are required to be used as part of the Work and shall also pay for Contractor's owned equipment at the Place of the Work which are required to be used as part of the Work, each based on the actual time such equipment is used beyond the period the equipment was expected to be at the Place of Work, exclusive of operators time, and on the following basis:

(i) At commercially reasonable established hourly, daily, weekly or monthly rental rates for the local market.
(ii) The stipulated rental rates will apply when the number of hours the equipment is operated does not exceed 175 hours in any one month or does not exceed 40 hours in any one week or does not exceed 8 hours in any one day.
(iii) For rental rates quoted, no differentiation will be made between equipment owned by Contractor or rented by Contractor from third parties.
(iv) For equipment not already on site, rental agreements and copies of invoices from equipment Rental Company must be submitted by the Contractor.

.9 Where the Contractor arranges for work to be carried out by a Subcontractor or the Contractor’s own forces, the Owner shall as applicable:

(i) Pay the Contractor the approved cost of a Subcontractor's work or the Contractor’s own forces, plus a 10% mark-up to the Contractor which shall be considered fair and full compensation for the Contractor’s administration, supervision, record documentation, overheads and profits.
(ii) Pay the Subcontractor via the Contractor for actual Field Labour, material and equipment costs of work performed plus a 10% mark-up to cover the cost of small tools, expendables and consumables (which shall include all items which are consumed in the performance of the Work), field overhead, supervision above working foreman level and all other indirect labour and materials costs not defined as reimbursable.
(iii) Pay an additional 5% mark-up to the Subcontractor via the Contractor for the profit and overhead associated with Change Orders and Change Directives that are a result of the of a Subcontractor’s necessity to further subcontract out a portion of the work to a third party.

.10 Notwithstanding the foregoing, the maximum mark-up permitted on any Change Order or Change Directive will not exceed an aggregate total of 25%.

.11 The costs for the following items are included in the allowance for overhead and profit:
(i) Contractor's head office expenses.
(ii) Wages of project managers, superintendents, assistants, safety, watchpersons and administrative personnel.
(iii) Temporary site office expenses, including costs for telephone and facsimile machine.
(iv) As constructed drawings.
(v) Time for estimating changes in the Work.

.12 When Change Orders or Change Directives are agreed by the Owner to proceed on a time and material basis the Contractor must:
.1 Maintain detailed daily records of the work performed by the Contractor. Contractor to report the labour and equipment employed and the material used on any specific portion of the Work, including the names, occupations and hours worked of all personnel employed that performed work on a time and material basis, the material supplied, and the description and hours of use for equipment and tools employed.
.2 Maintain and keep complete and accurate books, payrolls, accounts, and records relating to the Work or any extensions or additions thereto or claims arising therefrom to permit the verification and audit thereof and the Contractor will have no claim for repayment or any nature and kind whatsoever therefore, unless such books, payrolls, accounts and records have been so maintained and kept.
.3 Permit the Owner, its Consultant, or their agents to inspect and audit the books, payrolls, accounts, and records of the Contractor at any time during the period of the Contract and at any time thereafter at their discretion and upon written notice to the Contractor, and the Contractor will cooperate and promptly supply any records required by the Owner or Consultant as applicable.

1.16 GC 6.3 - CHANGE DIRECTIVE

.1 Add the following to the end of paragraph 6.3.1:

"6.3.1 The Contractor shall not be entitled to submit a claim or receive payment for any addition or revision to the Work without having first obtained written approval to proceed with the addition or revision by way of an approved Change Order or a written Change Directive. For greater clarity, the Contractor shall be precluded from making a claim for an adjustment in Contract Price or an extension of time to the Contract and shall be deemed to have waived any entitlement to such a claim if the addition or revision to the Work is commenced and/or completed without a written and accepted Change Order or Change Directive."

1.17 GC 6.5 - DELAYS

.1 In paragraph 6.5.1, Delete the words "or indirectly".

.2 Delete the last sentence of paragraph 6.5.1 and replace with the following:

"The Contractor shall be reimbursed by the Owner for reasonable direct costs, excluding any consequential, indirect or special damages, incurred by the Contractor as a result of such delay."

.3 Delete the last sentence of 6.5.2 and replace with the following:

"The Contractor shall be reimbursed by the Owner for reasonable direct costs, excluding any consequential, indirect or special damages, incurred by the Contractor as a result of such delay."

.4 Add new subparagraph 6.5.6:

"6.5.6 If the Contractor is delayed in the performance of the Work by an act or omission of the Contractor or anyone employed or engaged by the Contractor directly or indirectly, or by any cause within the Contractor's control, then the Contract Time shall be extended for such reasonable time as the Consultant may decide in consultation with the Contractor. The Owner shall be reimbursed by the Contractor for all reasonable costs incurred by the Owner as the result of such delay, including all services required by the Owner from the Consultant as a result of such delay and, in particular, the cost of the Consultant's services required during the period between the date of Ready-for-Takeover stated in Article A-1 herein and, the actual date of Ready-for-Takeover achieved by the Contractor."

.5 Add new subparagraph 6.5.7:

"6.5.7 For greater certainty, extensions of time shall be granted to the Contractor for any delays that result from a government order or action under the Emergency Management and Civil Protection Act, and such delays shall be deemed to be a valid order not issued as the result of an act or fault of the Contractor for the purpose of section 6.5.2., and a cause beyond the Contractor's control for the purpose of section 6.5.3. "

.6 Add new subparagraph 6.5.8:

"6.5.8 The Contractor acknowledges and agrees that it shall make reasonable efforts to mitigate any additional costs and time delays incurred in completing the Project as a result of any delay in the Work, regardless of the cause of such a delay."

.7 Add new subparagraph 6.5.9:

"6.5.9 If a delay that is not caused by the action or omission of the Owner, Consultant, or anyone employed or engaged by them directly, persists for more than 30 days, the Owner may elect, at its sole discretion, to suspend or terminate the Project and:

(a) if the delay is due to factors outside the Contractor's reasonable control, the amount for work due and payable to the Contractor will be apportioned in the ratio that the Work has been completed to the date of termination, subject to and in consideration of any advance payments made by the Owner; and

(b) if the delay is due to factors reasonably within the Contractor's control, the Contractor shall not be entitled to any further payments, unless otherwise agreed to by the Owner, in respect of the work performed by the Contractor in respect to the Project and the Contractor shall indemnify the Owner for all losses suffered by the Owner as a result of such delay and resulting from those further delays and expenses which the Owner may incur in finding a replacement for the Contractor for the Work and the Project, but excluding any consequential, indirect or special damages."

.8 Add new subparagraph 6.5.10:

"6.5.10 Upon of the occurrence of any delay pursuant to GC 6.5 the Contractor shall demonstrate the impact of the delay on each subsequent schedule update."

1.18 GC 9.2 - TOXIC AND HAZARDOUS SUBSTANCES

.1 Add to paragraph 9.2.6 after the word "responsible" in the second line of the paragraph, the following new words:

"or whether any toxic or hazardous substances or materials already at the Place of the Work (and which were, when encountered by the Contractor, harmless, stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were subsequently dealt with by the Contractor or anyone for whom the Contractor is responsible, in such a manner which is contrary to legal and regulatory requirements, renders them harmful, or causes them to become a threat to human health and safety or the environment, or material damage to the property of the Owner or others,"

.2 Add to paragraph 9.2.8 after the word "responsible", the following new words:

"or that any toxic or hazardous substances or materials already at the Place of the Work (and which were, when encountered by the Contractor, harmless, stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were subsequently dealt with by the Contractor, or anyone for whom the Contractor, is responsible, in such manner which is contrary to legal and regulatory requirements, renders them harmful, or causes them to become a threat to human health and safety or the environment, or material damage to the property of the Owner or others,"

.3 Add new paragraph 9.2.10:

"9.2.10 For the purposes of this General Condition the terms "toxic and hazardous substances and materials" shall be taken to mean and shall be limited to only substances as currently defined in the applicable statutory, regulatory and municipal requirements."

1.19 GC 10.2 - LAWS, NOTICES, PERMITS AND FEES

.1 Delete and replace paragraph 10.2.1 with the following:

"The laws and regulation applicable in the Province of Ontario shall govern the Work, including the Construction Act as it is in force."

.2 Delete from the first line of paragraph 10.2.2 the words, "building permit".

1.20 GC 10.4 - WORKERS' COMPENSATION

.1 Delete and replace paragraph 10.4.1, with the following:

"Prior to commencing the Work, and with each application for payment, and again with the Contractor's application for payment of the holdback amount following Substantial Performance of the Work and again with the Contractor's application for final payment following Ready-for-Takeover, the Contractor shall provide evidence of compliance with workers' compensation legislation at the Place of the Work, including payments due thereunder."

1.21 GC 12.3 - WARRANTY

.1 Add new paragraph 12.3.7:

"12.3.7 Carrying out of replacement work and making good of defects as described in the Contract Documents shall be executed at times convenient to the Owner. Such work may be required to be performed outside normal working hours at no additional cost to the Contract."

1.22 PART 14 – MISCELLANEOUS

.1 Add PART 14- MISCELLANEOUS as follows:

"PART 14 – MISCELLANEOUS

GC 14.1 - GENERAL

14.1.1 The Contractor acknowledges that during the term of the Contract, the Place of the Work and the area in the vicinity of the Place of the Work is, and will be, occupied by the Owner and others and that they will continue to carry out their normal operation and use of Place of the Work which includes continuous water treatment.

GC 14.2 - WARRANTY SECURITY

14.2.1 The Contractor will provide to the Owner for the duration of the period of the warranty obligations under GC 12.3 (the "**Warranty Period**") a financial amount to act as security for the fulfillment of the Contractor's warranty obligations (the "Warranty Security"), the value of which will be calculated based on the following table:

Contract Price (m = $1,000,000)		
Less than 0.1M		Value of Warranty Security 4% of Final Contract Price
0.1M	0.5M	4,000 on first 0.1M + 3.0% on next 0.4M
0.2M	1.0M	16,000 on first 0.5M + 2.4% on next 0.5M
1.0M	2.0M	28,000 on first 1.0M + 2.2% on next 1.0M
2.0M	4.0M	50,000 on first 2.0M + 2.0% on next 2.0M
4.0M	6.0M	90,000 on first 4.0M + 1.8% on next 2.0M
6.0M	10.0M	126,000 on first 6.0M + 1.5% on next 4.0M
Over 10.0M		186,000 on first 10.0M + 1.0% on balance

14.2.2 In addition to any holdback required to be retained by the Construction Act and in addition to any other holdback as may otherwise be agreed to by the Parties, the Owner will retain, until expiry of the Warranty Period, the Warranty Security, calculated in accordance with paragraph 14.2.1. The Parties agree and acknowledge that the Owner may apply the Warranty Security in whole or in part in order to reimburse the Owner for losses, costs incurred, or funds expended by the Owner as a result of default by the Contractor to fulfill the warranty obligations as set out in the Contract. Warranty Security.

14.2.3 The Warranty Security holdback shall be retained by the Owner in the increments calculated in accordance with paragraph 14.2.1 from the monies that would otherwise be payable to the Contractor, commencing at 70% completion of the Contract, so that by the date of Substantial Performance of the Contract the full value of the required Warranty Security has been retained. The Contractor shall be required to show the amount to be retained by the Owner on the Proper Invoice submitted by the Contractor and calculated in accordance with the increments in paragraph 14.2.1. The requirement to show the amount to be retained for the Warranty Security shall commence when the Contractor submits its first Proper Invoice once the Work has been completed to the value of 70% of the Contract Price has been performed.

14.2.4 The Warranty Security holdback is in addition to any other rights or remedies of the Owner in respect to the correction of the Contractor's default of the Contractor's warranty and maintenance obligations.

14.2.5 The Contractor may apply in writing to the Consultant and the Owner at the time of Substantial Performance to substitute for the monies retained as the Warranty Security for an alternative Warranty Security of equivalent or greater value comprising:
(a) one or more irrevocable letters of credit, or
(b) another readily negotiable security.

Acceptance of any such alternative shall be at the sole discretion of the Owner.

Following receipt and acceptance of any such alternative, the Owner will release to the Contractor the monies previously retained for Warranty Security purposes.

14.2.6 At the end of the Warranty Period, the Contractor may apply for a Final Acceptance Certificate by submitting to the Consultant and the Owner:
(a) A Statutory Declaration in a form acceptable to the Consultant and the Owner, signed by the Contractor stating that all accounts for labour, subcontracts, Products, Construction Equipment and other indebtedness which may have been incurred by the Contractor in connection with the Contract, have been paid in full;
(b) Provide evidence of compliance with workers' compensation legislation at the Place of the Work, including payments due thereunder; and
(c) The final deficiency list issued by the Consultant, completed with the date when each deficiency was corrected.

14.2.7 Any amounts retained by the Owner in accordance with this GC 14.2, which have not been used shall be returned to the Contractor, without interest, ten (10) Working Days after the later of:
(a) the date on which the Final Acceptance Certificate is issued by the Consultant following the Contractor's application for same in accordance with the requirements of paragraph 14.2.6
(b) the end of the Warranty Period; and
(c) the correction of any defective or deficient work which the Owner has notified the Contractor of prior to the end of the Warranty Period.

14.2.8 Upon expiration of the Warranty Period, the Consultant may endorse the release of the Warranty Security to the Contractor on such terms and conditions as the Consultant deems advisable notwithstanding that the Final Acceptance Certificate has not been issued and all deficiencies and incompletions have not been rectified in accordance with the requirements of the Contract.

GC 14.3 - LIQUIDATED DAMAGES-SUBSTANTIAL PERFORMANCE

14.3.1 If the date of Substantial Performance of the Work is delayed past the scheduled date for Substantial Performance of the Work set out in paragraph 1.3 of the Agreement, subject to any agreed adjustment in Contract Time as provided for in the Contract Documents (the "Scheduled Date"), the Contractor shall pay to the Owner as its sole and exclusive remedy for a failure to timely achieve Substantial Performance of the Work, liquidated damages in the amount of one thousand five hundred dollars ($1,500) per day for each day of delay after the Scheduled Date until the Contractor has attained Substantial Performance of the Work. The Contractor shall make payment of liquidated damages on a weekly basis as they accrue.

14.3.2 If there is a delay in attaining Substantial Performance of the Work, and regardless of any payment of liquidated damages in accordance with paragraph 14.3.1, the Contractor shall continue to perform and expedite the Work in accordance with the Contract.

14.3.3 The parties agree that it is difficult to calculate the damages which would result from the Contractor's failure to attain Substantial Performance of the Work by the Scheduled Date; and the parties agree that the liquidated damages payable in accordance with paragraph 14.3.1 are not intended to be a penalty but rather represent the parties' best estimate of, and are a genuine pre-estimate of, the damages resulting from the delay in attaining Substantial Performance of the Work by the Scheduled Date. Actual costs arising from the work required beyond the Scheduled Date will be determined after the date of Substantial Performance, and the amount of Liquidated damages paid shall be adjusted accordingly.

14.3.4 For greater certainty, the payment of liquidated damages shall not limit or otherwise affect any obligation or responsibility of the Contractor, or any right or remedy of the Owner, that does not relate to the Contractor's delay in attaining Substantial Performance of the Work by the Scheduled Date."

END OF SECTION

PART B – TECHNICAL SPECIFICATIONS

1.1 SUMMARY

.1 This section specifies general requirements relating to commissioning of all components, equipment, sub-systems, systems and integrated systems.

1.2 COMMISSIONING AGENCY

.1 Contractor shall retain and pay for a commissioning agency to provide a Commissioning Agent for commissioning services for the Project.

.2 Commissioning Agent to be experienced in the commissioning of related civil, mechanical, electrical and control systems in a municipal environment. Commissioning Agent to have demonstrated commissioning experience related to wastewater treatment/pumping systems in at least three projects of similar size and nature. Client references to be provided for all three projects.

.3 Submit qualifications of proposed Commissioning Agent, twenty (20) Working Days after contract commencement. If the proposed Commissioning Agent does not meet the stated requirements as determined by the Consultant, the Contractor is to propose an alternate individual who meets the stated requirements. If the alternate individual's qualifications are rejected, the Contractor shall retain the services of a third-party Commissioning Agency/Agent of the Owner's choosing.

1.3 CONTRACTOR RESPONSIBILITIES

.1 Prepare each system ready for commissioning. Verify systems installation is complete and in operation.

.2 Coordinate commissioning with and assist commissioning agency.

.3 Coordinate commissioning agency's involvement in Shop Drawing review process.

.4 Perform and document verification, performance testing, adjusting, and balancing operations.

.5 Cooperate with commissioning agency and provide access to equipment and systems.

.6 Provide personnel and operate systems at designated times, and under conditions required for proper commissioning.

.7 Assign additional commissioning staff and resources as required to maintain project timelines.

.8 Contractor to ensure that instrumentation is available and operational for commissioning agency to facilitate spot checks during commissioning.

.9 Participate in and assist in the coordination of commissioning meetings. Invite Subcontractors, Suppliers, Manufacturers, etc. as requested to attend as needed.

.10 Complete commissioning forms as requested by commissioning agency.

.11 Correct deficiencies identified in commissioning process.

.12 Incorporate commissioning data into operation and maintenance manual.

.13 Ensure that commissioning agency participates in demonstration and training as specified in Section 01790 Demonstration and Training.

1.4 COMMISSIONING AGENT RESPONSIBILITIES

.1 The commissioning agent will:
- .1 Prepare a commissioning plan, including systems to be commissioned, forms, checklists and responsibilities of commissioning team members.
- .2 Implement the commissioning plan and lead the commissioning team through start-up, verification, performance testing, training, and document preparation.
- .3 Review and provide comment on completed commissioning sheets. Identify if commissioning testing is acceptable or if re-testing is required due to deficiencies or non-conformances.
- .4 Review the draft and subsequent revisions of the commissioning schedule and provide comment.
- .5 Maintain involvement in and awareness of construction activities to assure compliance with system commissioning requirements.
- .6 Attend and participate in construction progress meetings.
- .7 Develop a working knowledge of the operation of the existing facility through reviewing the design drawings and specifications, visiting the facility with operations staff, reviewing other available information such as the operation and maintenance manuals, Environmental Compliance Approval, etc.
- .8 Convene, chair, prepare and distribute minutes of commissioning meetings.
- .9 Supervise commissioning activities and witness inspections and tests.
- .10 Make periodic site visits for the purpose of selective checking of accuracy of commissioning form submissions and witness testing.
- .11 Review and provide comment on content of operations and maintenance and commissioning manuals.
- .12 Prepare and issue commissioning report, verifying system commissioning is complete.

1.5 CONSULTANT RESPONSIBILITIES

.1 The Consultant will:
- .1 Participate in commissioning meetings and witnessing of FAT
- .2 Review verification and performance test results and direct Contractor to correct defects or deficiencies in the Work.
- .3 Issue Supplemental Instructions or Change Directives identified as necessary by the commissioning process.
- .4 Review final commissioning report.

1.6 OWNER/OPERATOR RESPONSIBILITIES

.1 The Owner and OCWA will:
- .1 Assign operations and maintenance personnel to participate in meetings, witnessing of demonstration, and training.
- .2 Designate a person to acknowledge receipt of reports.
- .3 Review and comment on the contractor’s Commissioning Plan and Schedule as needed.
- .4 Approve various testing/commissioning milestones as outlined above and identified in the technical specification sections.
- .5 Operate equipment, process units, and devices manually and/or from SCADA, when required, with the support of contractors and the Systems Integrator.

1.7 MANUFACTURER RESPONSIBILITIES

.1 The Manufacturer will:
- .1 Be an authorized representative, trained and certified in the installation, operation, and maintenance of specified equipment and systems.
- .2 Be available for on-site testing, inspection, or other manufacturer on-site services as identified in Division 01 or the technical specification sections.
- .3 Provide manufacturers installation, start-up and operation instructions prior to start-up of components, equipment and systems. Review with Commissioning Agent and Consultant.
- .4 Provide assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of the Contractor's assembly, erection, installation, or application procedures.
- .5 Inspect, check, and adjust as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
- .6 Review start-up procedures with Contractor and identify concerns related to equipment performance. Modify procedure as per Manufacturer recommendations.
- .7 Provide copies daily of all manufacturers' representatives' field notes and data to the Consultant.
- .8 Revisit the project site as required to correct problems until installation and operation are acceptable to the Consultant.
- .9 Resolve assembly or installation problems attributable to, or associated with, respective manufacturer's products and systems.
- .10 Provide assistance during functional and performance testing and facility start-up and evaluation including establishing initial set points, operational ranges and tolerances.
- .11 Train the Owner's personnel in the operation and maintenance of equipment.

.2 Integrity of Warranties:
- .1 Use manufacturers' trained start-up personnel as recommended by Manufacturer or as specified.
- .2 Verify with manufacturer that performance testing as specified will not void warranties.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit no later than twenty (20) working days after commence work date the name of the Commissioning Agency, qualifications, and Client references.

.2 Request in writing to Commissioning Agent and Consultant for changes to submittals and obtain written approval at least twelve (12) weeks prior to start of Commissioning.

.3 Submit proposed Commissioning procedures to Commissioning Agent and Consultant and obtain written approval at least twelve (12) weeks prior to start of Commissioning.

1.9 COMMISSIONING PLAN

.1 Provide a detailed Commissioning Plan in accordance with Section 01021 Equipment Testing and Commissioning.

1.10 COMMISSIONING SCHEDULE

.1 Provide a detailed Commissioning schedule in accordance with Section 01320 Construction Progress Documentation.

1.11 COMMISSIONING MEETINGS

.1 Conduct Commissioning Meetings in accordance with Section 01319 Project Meetings.

1.12 CHEMICAL SUPPLY

.1 The Contractor shall use potable water in lieu of chemicals for testing and commissioning. The Contractor is to advise the Consultant in cases where the use of potable water is not appropriate for initial testing and start-up procedures.

.2 Owner will arrange and pay for any chemicals required when the system is put into permanent operation.

.3 The delivery of the chemical supply will follow the successful commissioning by the Contractor.

.4 Contractor is responsible for coordination with the Owner on the delivery of the chemical supply to meet the commissioning schedule.

1.13 WATER SUPPLY FOR TESTING

.1 Municipal water may be used for testing purposes. Coordinate with OCWA and Owner prior to using water. It is the Contractor's responsibility to determine how water will be managed for testing and provide equipment as needed for such purposes throughout the project limits,

1.14 FUEL SUPPLY

.1 Provide and pay for any temporary fuel required to accommodate start-up, testing, and commissioning of equipment and systems.

1.15 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer. Maintain a log of maintenance work as it is completed and submit to the Owner prior to final acceptance.

.2 After completion of commissioning, operate and maintain systems until Consultant issuance of Substantial Performance certificate.

.3 Following trial operation period, replace all lubricants in equipment supplied in the Contract.

1.16 START OF COMMISSIONING

.1 Notify Commissioning Agent and Consultant at least twenty-one (21) calendar days prior to start of

Commissioning.

1.17 PERFORMANCE VERIFICATION

.1 Commissioning to be carried out in all modes of operation: regular, emergency, day, night, heating and cooling. Conduct commissioning:

.1 Under actual operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

1.18 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance, and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Commissioning Agent and Consultant.

1.19 COMMISSIONING CONSTRAINTS

.1 Coordinate and schedule work to maintain operation of existing pumping and treatment systems at all times. If shutdown of the facility is required to tie-in new works, maximum duration of shutdown is to be four (4) hours. Coordinate shutdown during low flow periods, which may include nighttime work, during dry weather, and other conditions as deemed necessary to complete the work in maximum allotted time.

.2 Prior to work requiring temporary shutdown of facility, provide temporary bypass pumping system. A temporary bypass pumping plan is to be provided for review prior to undertaking the work. Maintain operation of temporary bypass pumping system until satisfactory completion of commissioning and witnessed functional performance test of the new works.

.3 Two pumps must be able to operate at all times, schedule work on existing pumps accordingly.

.4 Forcemain must be tested independently from the pumping station prior to tie-in.

.5 All timing windows and permits must be followed with regards to work being completed.

1.20 NON-CONFORMANCE RELATED TO COMMISSIONING PROTOCOL

.1 All costs related to deficient or non-conforming work including but not limited to corrective work, testing, inspections and commissioning including related personnel to determine acceptability and proper performance of equipment or systems is by the Contractor.

.2 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Consultant. Corrective actions will be based on recommendations of independent testing agency report and upon approval of Commissioning Agent and Consultant.

.1 If equipment or system has been compromised and the warranty is no longer valid with the

Manufacturer, the Commissioning Agent and/or Consultant shall reject equipment. The following actions shall be taken by the Contractor:

.1 Remove and dispose from site rejected equipment. Replace with new equipment.
.2 Perform all procedures as identified in Section 01021 Equipment Testing and Commissioning.

1.21 TRAINING

.1 Provide training in accordance with Section 01790 Demonstration and Training.

1.22 COMPLETION OF COMMISSIONING

.1 Upon completion of Commissioning leave systems in normal operating mode.

END OF SECTION

1.1 DEFINITIONS

.1 **Factory Acceptance Testing (FAT)**: FAT is the testing and validation of operation of newly manufactured and packaged equipment by the Manufacturer at their facility to verify that the equipment meets the project specifications and all other requirements. Functional issues that are discovered during the testing are to be corrected and the equipment retested until all issues are successfully resolved.

.2 **Equipment Installation and Start-up**: The physical installation of the equipment in accordance with the manufacturer's recommendations and the Contract Documents. This step verifies that the equipment is ready for commissioning and can include but not be limited to verification of items such as overall condition of equipment, free rotation of moving parts, safety devices are in place, accessories have been installed, verification of belts and chains adjustment, etc. Refer to technical specification sections for additional requirements.

.3 **Equipment and Subsystem Functional Performance Testing**: The initial operation after Installation and Startup by the Contractor to demonstrate and confirm that the device, equipment, or subsystem meets manufacturer's installation, calibration and adjustment requirements and prove the functionality of the equipment or device in all modes of operation fit for it's intended purpose. Refer to technical specification sections for functional attributes.

.4 **Systems Functional Performance Testing**: The operation of a complete system, including all its related equipment, devices, instrumentation and subsystems, to prove the functionality of the system in accordance with the manufacturer's calibration and setpoint adjustments for all modes of operation. During performance testing, equipment is operated as an integral component within the related system, in order that operation responds to varying inputs that may occur. Refer to technical specification sections for system requirements.

.5 **Training**: Training as identified in Section 01790 and as required in relevant technical specification sections. Training shall take place prior to completing any performance trial operation.

.6 **Performance Trial Operation**: A continuous fourteen (14) calendar day full-scale in-service test of all systems within a facility, operated as a whole and integrated with existing equipment or systems. Several trial operations may be required depending on the nature and sequencing of the project as well as the type and severity of any automated operational errors or failure events.

.7 **Operating Authority**: Owner's agency responsible for the control, monitoring and operation of the overall treatment and/or pumping system.

.8 **Systems Integrator**: Trained personnel in SCADA/PLC programming responsible for testing, commissioning and integrating devices, equipment, and systems together as a whole, that allows operators to have control and monitoring of the system, so that the system can operate in all modes of operation.

.9 **Manufacturers Representative**: Factory trained technical representatives or manufacturer's certified representative. This person must be experienced in the operation and calibration of the equipment. The manufacturer's representative must be equipped with the necessary tools and equipment to successfully complete start-up activities per the manufacturer's recommendations and per any additional requirements indicated in technical specifications. The manufacturer's representative must be capable of disassembling related equipment to make repairs and/or adjustment.

.10 **Commissioning**: Inspect installation, calibrate as per contract, and program as per contract. The manufacturer's representative shall be present for the commissioning of equipment. During commissioning, equipment is operated and set-up to operate as an integral component within the related system, in order that operation responds to variances and changes that may occur in the system operation.

1.2 GENERAL

.1 Provide all labour and material to plan, organize, and implement the commissioning process for systems and equipment.

.2 Carry out initial commissioning and follow-up seasonal commissioning.

.3 Coordinate commissioning activities with all trades, suppliers, and contractors.

1.3 SUBMITTALS

.1 Prepare a commissioning plan including systems to be tested and commissioned, performance trial operation, forms, checklists, training, and responsibilities of commissioning team members. The draft commissioning plan is to be submitted twelve (12) weeks prior to any commissioning activities.

.1 Updated documents to be submitted fourteen (14) working days prior to related testing except for the 14-Day Test Plan.

.2 14-Day Test Plans: Submit at least thirty (30) working days prior to commencement of 14-Day test for each Facility.

.2 Prior to the start of the commissioning process, provide certification of mechanical and electrical systems support, anchorage, and seismic restraint and certification of calibration for testing equipment, where specified.

.3 Manufacturer’s FAT testing documentation as required by technical specification sections.

.4 Installation certificates, accepted and executed by Contractor and Manufacturer, as required by technical specification sections.

.5 Start-up test sheets accepted and executed by Contractor, Manufacturer, Owner and Consultant as required by technical specification sections.

.6 Start-up reports for stand alone devices or equipment. Start-up Reports to include approved shop drawing information. Append a copy of the approved shop drawing to the report.

.7 Training Plan for all equipment and devices, indicating proposed dates and time slots.

.8 Functional Verification Reports for each piece of equipment.

.9 A System Functional Verification Report including a performance testing completion sign-off form.

.10 14-Day Facility Performance Test Completion sign-off form.

1.4 TESTING, COMMISSIONING AND PERFORMANCE TRIAL OPERATION OVERVIEW

.1 Coordinate equipment testing with Instrumentation and Controls Testing, as specified in Division 17.

.2 Step 1 – Factory Acceptance Testing (FAT):

.1 Commissioning Agent and Consultant to be present for factory acceptance testing.
.2 Coordinate time and location of testing.
.3 Coordinate and pay for travel, transportation to and from test site, and lodgings for the Commissioning Agent and one (1) Owner representative as required.
.4 Submit testing documentation to Commissioning Agent and Consultant for approval.
.5 Obtain written approval of test results and documentation from Commissioning Agent and Consultant before manufacturer release of equipment and delivery to site.

.3 Step 2 – Installation and Startup:
.1 Installation to be completed, inspected, and accepted by the Contractor and Manufacturer.
.2 Contractor and Subcontractor to correct deficient work prior to proceeding to Step 3.
.3 Prerequisite to Functional Performance Tests:
.1 Prior to Functional Performance testing of each equipment and subsystem, observe and verify that the physical installation of components and systems being tested is ready for Functional Performance Tests.
.2 Receive and verify documentation of testing indicating readiness for Functional Performance
.3 Tests.
.4 Provide a manufacturers certificate of installation free of deficiencies.
.5 Provide a start-up report indicating the adequacy of the installation, set points for any adjustable components and programmable parameters.
.6 Make available for Consultant's review, the functional verification report template, with all applicable and available information completed.

.4 Step 3 – Equipment and Subsystem Functional Performance Testing:
.1 Functional Performance Testing to be completed and accepted by the Contractor and Manufacturer, as required. Refer to Division 11.
.2 Notify Owner, Consultant, and manufacturer's representative in writing at least ten (10) working days prior to scheduled date of functional performance verification.
.3 Owner and Consultant are to verify functional test with Contractor.
.4 Operate equipment and subsystems through all specified modes of control and sequences of operation. Include full and part load and emergency conditions.
.5 Functionally verify operation of all safety limits and related alarming/monitoring.
.6 Contractor and Subcontractor to correct deficient work. The Contractor may not proceed to systems functional performance testing until equipment and subsystem functional performance testing is approved by the Consultant and Owner.
.7 Revise and submit functional test sheets for subsequent functional tests.

.5 Step 4 – Systems Functional Performance Testing:
.1 Systems Functional Performance Testing to be completed by the Contractor and accepted by the Consultant and Owner.
.2 Notify Owner and Consultant in writing at least ten (10) working days prior to scheduled date of systems functional performance testing.
.3 Owner and Consultant to verify systems functional testing with Contractor.
.4 Operate each system through all modes of operation (e.g., seasonal, occupied/unoccupied, warm-up/cool down, start-up/shut-down, etc.) including every interlock and conditional control logic, all control sequences, both full and part load conditions and simulation of all abnormal conditions for which there is a specified system or control response.
.5 Impose temporary upsets of systems, such as power failure, distribution fault, control loss, set-point change, and component failure to determine system stability and recovery time.
.6 Contractor and Subcontractor to correct deficient work. The Contractor may not proceed to Step 5 - Training until functional performance testing is approved by the Consultant and Owner.

.7 Revise and submit functional test sheets for subsequent functional test reviews.

.6 Step 5 – Training:
- .1 Training is to be completed by the Manufacturer and System Integrator.
- .2 Training on systems operation is to occur following systems functional performance testing.
- .3 Training on equipment may be scheduled the day after the successful start-up of equipment. Do not schedule training on the same day as the start-up of equipment.
- .4 Refer to technical sections for additional requirements.

.7 Step 6 – Performance Trial Operation:
- .1 Performance Trial Operation to be completed by the Contractor and Manufacturer and accepted by the Consultant and Owner.
- .2 Performance Trial Operation to be assisted by the Contractor per Item 1.7.
- .3 Prerequisite to Performance Trial Operation:
  - .1 Steps 1 to 5 must be successfully completed and accepted by Consultant and Owner.
  - .2 Notify Owner and Consultant in writing at least seven (7) working days prior to scheduled date of performance trial operation. Obtain written approval from Consultant and Owner that the Performance Trial Operation may proceed.
- .4 A written report of each specified trial operation will be required from the Contractor and will include items such as Contractor/Manufacturer statement of the results and acceptance of the trial operation, SCADA reports, SCADA trends, written notes, diary logs, performance testing data, summary documentation, etc.
- .5 If a significant interruption occurs, regardless of the cause, the 14-day period shall be re-started. However, if the interruption is a result of owner supplied equipment or services, the Contractor may request a continuation of the 14-day test instead of a re-start. Acceptance of this continuation is at the discretion of the Owner, Consultant and Operating Authority. Any continuation/re-start can only occur when the reason for the interruption has been corrected to the satisfaction of the Owner/Consultant.
- .6 Device and equipment functionality that cannot be completed due to seasonal conditions are to be noted in the test plan and scheduled when conditions are suitable for this purpose.

1.5 LEAKAGE, PIPE TESTING, AND OTHER TESTS

.1 Refer to Technical Sections for requirements related to leakage, pipe pressure testing, and other relevant testing to be completed prior to the commencement of testing and commissioning activities. Provide a checklist or form in the Commissioning Plan. Include the final document in the Commissioning Manual.

.2 Upon completion of structural and mechanical work, carry out the following tests:
- .1 Leakage and/or pressure test all retaining vessels, concrete tanks and chambers, in accordance with Divisions 3 .
- .2 Leakage and/or pressure test all piping and equipment as specified in this section and in Division 2 through 16.
- .3 Provide all necessary labour, testing equipment, gauges, temporary caps, plugs, valves, etc., to complete the tests as specified.

1.6 FUNCTIONAL PERFORMANCE TESTING

.1 Demonstrate to the Owner and/or Consultant the successful operation of equipment, system, and subsystems including normal and upset condition operating scenarios.

.2 Upset conditions to include the following, as a minimum:

.1 Power failure.
.2 Component failure
.3 Process variable(s) above and below normal operating range.

.3 Document Functional Performance with test checklists approved in Commissioning Plan. For each individual check or test, observe physical responses of system and compare them to the specified requirements to verify test results are acceptable.

.4 Carry out Functional Performance testing for all equipment, subsystems, systems and system interfaces and provide separate checklists for each.

.5 Deferred Functional Performance Tests:
.1 Identify any check or test which cannot be completed due seasonal restrictions, lack of occupancy, or any operational constraints and provide an alternative testing schedule.
.2 If any check or test cannot be completed due to construction of the works or other contract related deficiencies outside the scope of the systems start-up, these deficiencies should be corrected by the appropriate parties before completion of the commissioning process.
.3 Every check or test for which acceptable performance was not achieved should be repeated after the necessary corrections have been made.

.6 Sequence Functional Performance testing starting from components progressing to complete systems.

.7 Demonstrate operation of all alarms and remote signals. Verification to be completed under actual operating conditions or by simulating the same. Jumpering of contacts (e.g. permitting two contacts to connect so that an alarm will occur), will not be acceptable.

.8 Simulate analog inputs or outputs where a functional simulation is not practical. Generally, functional tests are considered practical for level, pressure, and temperature.

.9 Prior to any new systems and/or temporary systems being put into operation, related alarms and controls are to be tested and verified.

.10 Verification process is complete when every mode of systems operation, all system equipment, components and zones, and every item in the control sequence description is proved operational under all normal operational modes, including part and full load, and under abnormal or emergency conditions.

1.7 PERFORMANCE TRIAL OPERATION

.1 Refer to Technical Sections for additional prerequisite requirements to proceed with performance trial operation.

.2 Assist the Owner during continuous twenty-four (24) hour performance trial operations of the facility for fourteen (14) calendar days.

.3 Competent personnel are to be on-site or available to be on-site within two (2) hours from receiving a request from the Owner. This includes the General Superintendent, Mechanical and Electrical Superintendents, subtrades, and applicable equipment suppliers and system integrators.

.4 The period of the trial operation will be extended or restarted at the Contractor's expense if the performance trial operation does not meet the project requirements. The performance trial operation will be deemed complete upon receiving written acceptance from the Consultant and Owner.

1.8 PRODUCTS

.1 Water Supply for Testing - Refer to Section 01020.

1.9 ACCEPTANCE PROCEDURES

.1 Prerequisite to Functional Performance Testing:
- .1 Prior to Functional Performance testing of each system, observe and verify that the physical installation of components and systems being tested is ready for Functional Performance Tests.
- .2 Receive and verify documentation of testing indicating readiness for Functional Performance Testing.
- .3 Make available for Consultant's review, the functional performance report template, with all applicable and available information completed.

.2 Equipment and Subsystem Functional Performance Testing:
- .1 Operate equipment and subsystems through all specified modes of control and sequences of operation. Include full and part load and emergency conditions.
- .2 Functionally verify operation of all safety limits and related alarming/monitoring.

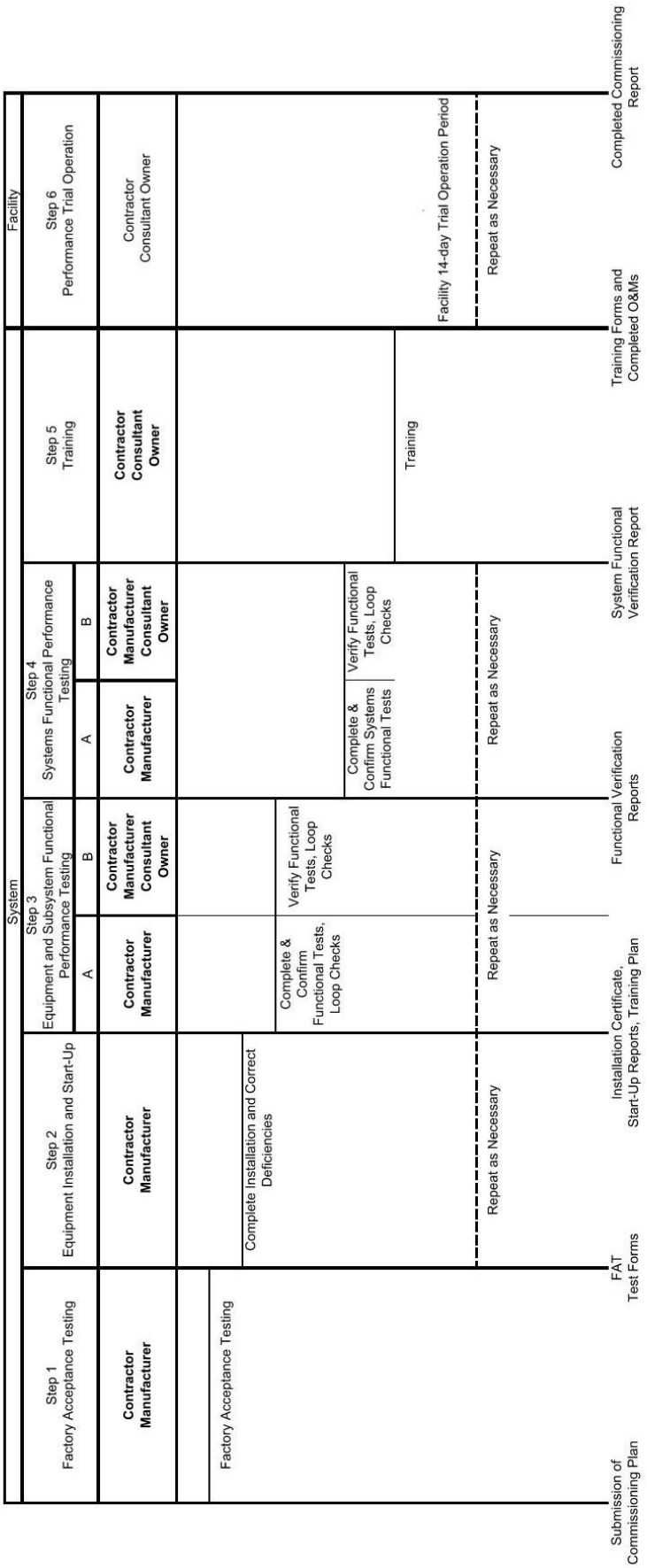
.3 Systems Functional Performance Testing:
- .1 Operate each system through all modes of operation (e.g., seasonal, occupied/unoccupied, warm-up/cool down, start-up/shutdown, etc.) including every interlock and conditional control logic, all control sequences, both full and part load conditions and simulation of all abnormal conditions for which there is a specified system or control response.
- .2 Impose temporary upsets of systems, such as power failure, distribution fault, control loss, set-point change, and component failure to determine system stability and recovery time.
- .3 Acceptance Documentation:
  - .1 Include Commissioning Plan and Functional Performance test results with the final Commissioning Manual (refer to Section 01780).

1.10 ACCEPTANCE OF SYSTEMS

.1 System acceptance is not achieved until the requirements of the Commissioning Plan have been achieved, documented by the Contractor, and accepted by the Consultant and Owner.

END OF SECTION

Commissioning Flow Chart



1.1 DEFINITIONS

.1 Designated Substances: Are those substances designated as hazardous by the Ministry of Labour under the Occupational Health and Safety Act. The following substances have been identified as designated substances:

- .1 Acrylonitrile
- .2 Arsenic
- .3 Asbestos
- .4 Benzene
- .5 Coke Oven Emissions
- .6 Ethylene Oxide
- .7 Isocyanates
- .8 Lead
- .9 Mercury
- .10 Silica
- .11 Vinyl Chloride
- .12 Polychlorinated Biphenyls (PCBs)
- .13 Halocarbons
- .14 Mould and Water Damage
- .15 Other Hazardous Materials; such as formaldehyde, cadmium, styrene, nickel and coal tar products

.2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities, and hazardous products, including but not limited to: corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.

.3 Polychlorinated Biphenyls (PCBs): includes chlorobiphenyls referred to in Column I of item 1 of the List of Toxic Substances in Schedule I of Canadian Environmental Protection Act (CEPA).

.4 Toxic: substance is considered toxic if it is listed on Toxic Substances List found in Schedule 1 of CEPA.

.5 List of Toxic Substances: found in Schedule 1 of CEPA, lists substances that have been assessed as toxic. Federal Government can make regulations with respect to a substance specified on List of Toxic Substances. Column II of this list identifies type of regulation applicable to each substance.

1.2 REFERENCE STANDARDS

.1 Refer to laws, by laws, ordinances, rules, regulations and orders of authority having jurisdictions, and other legally enforceable requirements applicable to Work at that area; or become in force during Work performance.

1.3 SECTION INCLUDES

.1 This Section clarifies Contractor's responsibilities and obligations to review the information provided in the "Designated Substances Report (DSRs)", pertaining to the Sites located at:

.1 224 Laurier Street, Casselman, Ontario, prepared by Lascelles Engineering & Associates Limited dated January/2019.

.2 16 Brisson Street, Casselman, Ontario, prepared by Lascelles Engineering & Associates Limited dated April/2025.

.2 A Copy of these DSRs are attached under a separate cover forming part of tender documents in Appendix No. 1.

1.4 RESPONSIBILITY

.1 Contractor shall be responsible for reading and evaluating the information provided in DSRs dated for the Sites.

.2 Contractor shall incorporate any recommendations in the Site DSRs dated, as they pertain to the health and safety of workers on Sites, in accordance with Section 01350 - Health and Safety Requirements and in compliance with authority having jurisdictions for that area.

.3 Contractor shall be responsible for the removal and disposal of the identified substances as part of the equipment removal and demolition work.

.4 Contractor shall exercise every reasonable precaution for the protection of each worker on the Sites.

.5 Contractor shall furnish the Site specific DSRs to all subcontractors who will be performing work on the Sites.

.6 Prior to beginning the Work, confirm with the Owner that additional designated substances have not been brought to project sites, since the date on which the Designated Substances Report were completed.

.7 Various chemicals and hazardous substances may be used in the process and are not identified within the scope of the Designated Substances Reports. Refer to the WHMIS/Manuals on-site.

1.5 ACTION AND INFORMATION SUBMITTALS

.1 Include in the site-specific Health and Safety Plan a list of relevant hazardous or contaminated materials or substances required by the authority having jurisdiction which need to be included in the Contractor's Health and Safety Plan.

END OF SECTION

1.1 WORK OF THE PROJECT

.1 The full scope of work is prescribed in detail in the attached tender documents. Without limiting the specifics of these requirements, the work generally consists of:

- .1 Brisson Street Casselman Main SPS No.1 Upgrades:
  - .1 Removal of the asphalt roof shingles and new metal roof.
  - .2 Implementation of new roof penetrations for the new ventilation exhaust system.
  - .3 Construction of a new electrical room, including a new MCC, VFDs, unit heater, AC cooling system, and ventilation.
  - .4 Provision of new electrical equipment, PLC, ATS, pump starters, and instrumentation to serve the pumping station.
  - .5 Supply and installation of two new sewage pumps, intake piping and header.
  - .6 Construction of new equipment concrete pads and pipe supports.
  - .7 Removal and replacement of the screening screw washer compactor unit.
  - .8 Rehabilitation of the mechanical bar screen unit.
  - .9 Construction of a new emergency overflow sewer discharging to the South Nation River.
  - .10 Replace electric motors on existing pump.

- .2 Brisson Street, right-of-way easement, Laurier Street and Casselman Lagoon property:
  - .1 Coordination, supply, installation, and commissioning of a new forcemain parallel to the existing forcemain from the SPS site to the Lagoon property.
  - .2 Coordination, supply, installation, and commissioning of drain and air release chambers along new alignment.
  - .3 Coordination, supply, installation, and commissioning of alum injection manhole and upgrades to pumping equipment, supports and communications at the alum building.
  - .4 Coordinate, connection and modifications to the existing splitter box at Lagoon property.
  - .5 Modifications to the alum injection system at the Lagoon property consisting of:
  - .6 Topsoil and Vegetation removal, landscaping and application of topsoil and hydroseed to disturbed area, including around the pumping station building.

- .3 The Contract Time will be from June 1, 2025 and shall have the works Ready-For-Takeover by November 30, 2026.

1.2 WORK OF THIS CONTRACT

.1 The Work of this Contract is comprised of the Work for the Casselman Main Sewage Pumping Station Upgrades, the new forcemain alignment construction, and the alum system upgrades in the Municipality of Casselman, as defined and detailed in the CCDC2 2020 entered into among Owner and Contractor (where the definitions of terms therein shall apply to this document), the Contract documents, and any amendments thereto.

1.3 DIVISION OF WORK

.1 Division of the Work among Subcontractors and Suppliers is solely the Contractor's responsibility. The Consultant and Owner assume no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of the Work.

1.4 SPECIFICATIONS LANGUAGE AND STYLE

.1 These specifications are written in the imperative mood and in streamlined form. The imperative language is directed to Contractor, unless stated otherwise.

.2 Complete sentences by reading "shall", " Contractor shall", "shall be", and similar phrases by inference. Where a colon (:) is used within sentences and phrases, read the words "shall be" by inference.

.3 Fulfill and perform all indicated requirements whether stated imperatively or otherwise.

.4 When used in the context of a Product, read the word “provide” to mean “supply and install to result in a complete installation ready for its intended use”.

.5 Read the word “Section” to mean “Specification Section”.

1.5 CONTRACT DOCUMENTS FOR CONSTRUCTION PURPOSES

.1 Owner will supply Contractor with a complete set of Contract Documents in electronic form before commencement of the Work. Contractor may print hard copies for construction purposes as required.

.2 The Consultant shall provide AutoCAD project files to the Contractor upon receipt of a request in writing, subject to the requirement that the Contractor and/or their Subcontractors execute and return a release letter in the form provided by the Consultant.

.3 The Consultant will not provide Issued for Construction design documents for this project. The provision of Issued for Construction documents shall not be a requirement to commence the Work or represent grounds for a change in schedule.

1.6 DOCUMENTS AT THE SITE

.1 Keep the following documents at Place of the Work, stored securely and in good order and available to Owner and Consultant in hard copy or electronic form:
- .1 Current Contract Documents, including Drawings, Specifications and addenda.
- .2 Change Orders, Change Directives, and Supplementary Instructions.
- .3 Reviewed Shop Drawings, Product data and samples.
- .4 Field test reports and records.
- .5 Construction progress schedule.
- .6 Meeting minutes.
- .7 Manufacturer’s certifications.
- .8 Permits, inspection certificates, and other documents required by authorities having jurisdiction.
- .9 Current as-built drawings.
- .10 Safety Data Sheets (SDS) for all controlled Products.
- .11 Deficiency and Punchlist Logs.

1.7 CONTRACTORS USE OF PREMISES

.1 Except as otherwise specified, Contractor has restricted use of Place of the Work from time of Contract award until Substantial Performance of the Work.

.2 Confine Construction Equipment, Temporary Work, storage of Products, waste products and debris, and all other construction operations to limits required by laws, ordinances, permits, and Contract Documents, whichever is most restrictive. Do not unreasonably encumber Place of the Work.

.3 The contractor shall have access to Municipality owned lands accessible at Brisson Street for construction and laydown. The contractor shall also have access to Municipality owned lands accessible at the right-of-way easement through the Casselman Municipal baseball field and Sainte-Euphémie School's driveway between Brisson Street and Laurier Street. It is the Contractor's responsibility to provide site security for their staging and laydown areas and reinstate disturbed areas following construction.

.4 The contractor shall be restricted from disturbing road structure, landscaping and associated surfaces within the Stage 3 Archaeological Area. The Stage 3 protection area will remain restricted until the completion of a Stage 3 Assessment is completed by a licenced Archaeologist. Refer to section 01561, Item 1.12

1.8 REMOVED/SALVAGED EQUIPMENT AND MATERIAL

.1 Except if expressly stated otherwise, materials which must be removed to perform the Work, or are indicated for removal, shall become the Contractor's property and shall be taken from project site and disposed of at no additional cost to the project.

.2 Demolition and Removal activities shall be coordinated with OCWA and the Municipality of Casselman to verify and confirm salvaging of removed equipment.:

.3 The Contractor shall provide written notice to the Owner two (2) weeks in advance of demolition and removal of various components. The Owner reserves the right to visit the project site within the two (2) week period and identify additional items to be salvaged and turned over to the Owner.

.4 Materials to be salvaged and turned over to the Owner shall be delivered to 16 Brisson Street or any other alternate location within 25 km of site, as directed by the Consultant. Contractor to unload salvaged items at the receiving location.

1.9 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures, and outlets indicated or specified shall be considered as approximate.

.2 Locate equipment, fixtures, and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access, and maintenance.

.3 Inform the Consultant of impending installation and obtain their approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by the Consultant.

.5 Provide detailed interference and coordination drawings when required by Specification Sections.

1.10 SECURITY

.1 Contractor shall coordinate with the Municipality and Conseil scolaire de district catholique de l'Est ontarien to comply with all Workplace policies on Criminal Background Checks of Offence Declarations on Service Providers.

1.11 PRECONSTRUCTION SURVEY

.1 A pre-construction survey shall be prepared by a third party professional firm with specific experience in completing such surveys and retained by the Contractor for all utilities, structures, surfaces, facilities, and equipment on or near the project site likely to be used or potentially impacted due to the proposed construction activities

.2 The pre-construction survey means a detailed record in written form accompanied by photographs and/or video of the condition of private and public property prior to the commencement of any construction activities. All existing structural and cosmetic damage or defects shall be clearly documented.

.3 The pre-construction survey for adjacent facilities and surfaces shall include the following:
   .1 Buildings, surfaces, and structures within a 125 m radius of work on Brisson Street.
   .2 Buildings, surfaces, and structures within a 125 m radius of 215 Laurier Street.
   .3 Buildings, surfaces, and structures within a 125 m radius of 224 Laurier Street.
   .4 Any other potentially affected buildings, surfaces, or structures found on surrounding neighborhood streets, if applicable.

.4 The Contractor shall review the third-party professional firms' Pre-Construction Survey Report and submit it to the Consultant within two (2) weeks of completing the survey prior to starting to enable work or construction activities.

.5 The pre-construction survey will be considered the basis by which claims for damages caused by construction activities will be evaluated.

1.12 FEES, PERMITS AND CERTIFICATES

.1 Pay all fees and obtain all required approvals and permits unless otherwise indicated. Provide authorities with plans and information for acceptance certificates. Furnish inspection certificates as evidence that work conforms to requirements of authority having jurisdiction.

.2 Apply for, obtain, and pay for Technical Standards & Safety Authority (TSSA) Certificate of Authorization for gas piping systems, chemical piping, and other systems.

.3 Owner will apply for, obtain, and pay for the Environmental Compliance Approvals (Sewage).

.4 Pay for advertisement of substantial completion.

.5 Work is subject to the approval, inspection, by-laws and regulations of all municipal, provincial, federal and other authorities having jurisdiction.

END OF SECTION

NO: _____

CONTRACTOR: _____ CONTRACT NO: _____

PROJECT: _____ SPEC SECTION: _____

OWNER: _____

ENGINEER: _____

CONTRACTOR/SUBCONTRACTOR: _____ DATE: _____
yyyy/mm/day

FOREMAN IN CHARGE: _____ CREW SIZE:_____

FACILITY/AREA AFFECTED: _____

SYSTEM/EQUIPMENT AFFECTED: _____

DATE OF SHUTDOWN: _____ TIME: _____

DURATION OF SHUTDOWN: _____

.1 WORK TO BE ACCOMPLISHED:

_____

_____

_____

.2 SHUTDOWN ACTIVITIES:

Activity	**Start Time / Stop Time**	**Special Requirements**

.3 APPROVAL AND COMMENTS:

_____

_____

_____

END OF SECTION

1.1 RESTRICTIONS ON USE OF PREMISES

.1 Maintain adequate access at all times throughout the work areas to allow;
  .1 Owner and operating agent (OCWA) occupancy for continuous operation of the facility.
  .2 Work by other contractors required for continuous operation of the facility.

.2 A Stage 3 Archaeological assessment shall be conducted concurrently to the project timeline. Access within the immediate vicinity will be restricted from a Stage 3 Protection area until conclusion of the Stage 3 Archaeological Assessment are determined. The Stage 3 Protection area is confined to the intersection of Brisson and Principal street to Station 0+140.
  .1 Refer to Contract Drawings in Appendix 1.
  .2 Refer to section 01561.

1.2 WORK SEQUENCE

.1 Schedule and construct Work in stages to accommodate Owner's continued use of premises during construction.

.2 Schedule and construct Work to minimize potential downtime for any facilities. Prior to work requiring temporary shutdown of facility, provide temporary bypass pumping system.

.3 Schedule and construct Work in accordance with timing windows and requirements associated with permits and approval authorities.

.4 Schedule and construct Work within nearby waterways during seasonal low water levels. All permit requirements must be followed; refer to DFO request for review. Permit must be obtained by the Contractor from the South Nation Conservation prior to Work. Refer to section 01561.

.5 Schedule and construct Work in conjunction with the Stage 3 Protection Area. Refer to section 01561.

.6 Two pumps must be able to operate at all times, schedule work on existing pumps accordingly.

1.3 OWNER OCCUPANCY

.1 Cooperate with Owner and OCWA in scheduling operations to minimize disruptions and to facilitate Owner/OCWA usage.

1.4 RESTRICTED HOURS OF WORK

.1 Construction hours are not limited to facility operating hours. However, the Contractor must observe all local by-laws with respect to working hours.

.2 Normal working hours for construction shall be limited to 7:00 a.m. to 6:00 p.m., Monday to Friday, excluding Statutory Holidays.

.3 Work on Saturdays or Sundays is prohibited, unless indicated or approved otherwise.

.4 Notify the Consultant or the Owner's representative, in writing, a minimum of four (4) working days in advance of any occasion on which the Contractor proposes to work outside of normal working hours.

.5 The Contractor shall be responsible to secure all buildings where construction is ongoing and to secure/lock all gates where project site access is possible at the end of each workday. The main project site access gate shall have a double lock system, allowing both the Owner and the Contractor to control project site access. The Contractor shall supply its own lock to provide a double lock system.

.6 Allow for hours of work restrictions in construction progress schedule.

1.5 NOISY WORK RESTRICTIONS IN OCCUPIED FACILITIES

.1 Schedule excessively noisy work to avoid disturbance to building occupants. Schedule excessive noise generating work in consultation with the Owner and OCWA in advance to avoid disruption to operations.

.2 Use powder actuated devices only with Consultant's written permission.

1.6 MAINTAINING LIFE SAFETY SYSTEMS IN OCCUPIED FACILITIES

.1 Maintain operational life safety systems and public/building occupant access to exits in occupied areas during all stages of the Work.

.2 Determine nature and exact locations of existing fire and smoke sensors prior to the commencement of the Work. Avoid direct or indirect jarring while working in adjacent areas and exercise caution to avoid triggering these devices.

.3 Be responsible for costs incurred by Owner on account of false fire alarms activated as a result of the execution of the Work without adequate precautions.

END OF SECTION

1.1 CASH ALLOWANCES FOR SERVICES

.1 Amount of each cash allowance includes:
  .1 All costs related to the services, excluding Value Added Taxes.
  .2 Subcontractor's and sub-Subcontractor's overheads and profits related to the cash allowance.

.2 Overhead and profit, and other related costs, shall be included in the Contract Price and not in the cash allowance.

.3 Allow the stipulated sum of $10,000 for the completion of any remediation work of any designated substances that have the potential to be disturbed/impacted as part of the scope of work.

.4 Allow the stipulated sum of $25,000 for the Owner's Independent third-party Geotechnical Engineer.

.5 Allow the stipulated sum of $30,000 for the support of Hydro Ottawa utilities both above and underground. Payment shall be full compensation to supply all materials, labour and equipment necessary for the support of Hydro Ottawa utility infrastructure to the satisfaction of Hydro Ottawa.

.6 Allow the stipulated sum of $30,000 for the Owner's Independent third-party Archaeologist to complete a Stage 3 Archaeological Assessment.

1.2 EXPENDITURE OF CASH ALLOWANCES

.1 Owner, through Consultant, will provide Contractor with documentation required to permit pricing of a cash allowance item.

.2 Owner, through Consultant, may request Contractor to identify potential Suppliers or Subcontractors, as applicable, and to obtain at least three competitive prices for each cash allowance item.

.3 Owner, through Consultant, may request the Contractor to disclose originals of all bids, quotations, and other price related information received from potential Suppliers or Subcontractors.

.4 Owner, through Consultant, will determine by whom and for what amount each cash allowance item will be performed. Obtain Owner's prior written approval in the form of a Change Order before entering into a subcontract, amending an existing subcontract, or performing own forces work included in a cash allowance. Upon issuance of the Change Order, the Contractor's responsibilities for a cash allowance item shall be the same as for other work of the Contract.

1.3 CONTINGENCY ALLOWANCE

.1 Include in the Contract Price a contingency allowance in the amount of $500,000.

END OF SECTION

1.1 DEFINITION

.1 In this Section “Substitution” means a Product, a manufacturer, or both, not originally specified in Contract Documents by proprietary name but proposed for use by Contractor in place of a Product, a manufacturer, or both, specified by proprietary name.

1.2 SUBSTITUTION PROCEDURES

.1 Contractor may propose a Substitution wherever a Product or manufacturer is specified by proprietary name(s), unless there is accompanying language indicating that Substitutions will not be considered.

.2 Contractor may propose a Substitution wherever a Product or manufacturer is specified by proprietary name(s) and accompanied by language such as "or equal", "or approved equal", or other similar words. Do not construe such language as an invitation to unilaterally provide a Substitution without Consultant’s prior acceptance in writing. Do not order or install any Substitution without a Supplemental Instruction or Contract Change Order.

.3 Provided a proposed Substitution submission includes all of the information specified in this Section under Submission Requirements for Proposed Substitutions, Consultant will review and accept or reject the proposed Substitution.

.4 Allow for a minimum of ten (10) Working Days for Consultant evaluation. The minimum duration is subject to change dependent on the complexity of the substitution request.

.5 Consultant may accept a Substitution if satisfied that:

- .1 the proposed substitute Product is the same type as, is capable of performing the same functions as, interfaces with adjacent work the same as, and meets or exceeds the standard of quality, performance and, if applicable, appearance and maintenance considerations, of the specified Product,
- .2 the proposed substitute manufacturer has capabilities comparable to the specified manufacturer, and
- .3 the Substitution provides a benefit to Owner.

.6 If Contractor fails to order a specified Product or order a Product by a specified manufacturer in adequate time to meet Contractor’s construction schedule, Consultant will not consider that a valid reason to accept a Substitution.

.7 If Consultant accepts a Substitution and subject to Owner’s agreement, the change in the Work will be documented in the form of either a Supplemental Instruction or Change Order as specified in Section 01260 Contract Modification Procedures.

.8 If a Substitution is accepted in the form of a Supplemental Instruction or Contract Change Order, Contractor shall not revert to an originally specified Product or manufacturer without Consultant’s prior written acceptance.

1.3 SUBMISSION REQUIREMENTS FOR PROPOSED SUBSTITUTIONS

.1 Include with each proposed Substitution the following information:

.1 The submission form as provided in Section 01250A as the cover sheet for the proposed substitution information.

.2 Identification of the Substitution, including product name and manufacturer's name, address, telephone numbers, and web site.

.3 Reason(s) for proposing the Substitution.

.4 A statement verifying that the Substitution will not affect the Contract Price and Contract Time or, if applicable, the amount and extent of a proposed increase or decrease in Contract Price and Contract Time on account of the Substitution.

.5 A statement verifying that the Substitution will not affect the performance or warranty of other parts of the Work.

.6 Manufacturer's Product literature for the Substitution, including material descriptions, compliance with applicable codes and reference standards, performance and test data, compatibility with contiguous materials and systems, and environmental considerations.

.7 Product samples as applicable.

.8 A summarized comparison of the physical properties and performance characteristics of the specified Product and the Substitution, with any significant variations clearly highlighted.

.9 Availability of maintenance services and sources of replacement materials and parts for the Substitution, as applicable, including associated costs and time frames.

.10 If applicable, estimated life cycle cost savings resulting from the Substitution.

.11 Details of other projects and applications where the Substitution has been used.

.12 Identification of any consequential changes in the Work to accommodate the Substitution and any consequential effects on the performance of the Work as a whole. A later claim for an increase to the Contract Price or Contract Time for other changes in the Work attributable to the Substitution will not be considered.

END OF SECTION

1.1 SUBSTITUTION CHECKLIST FORM

.1 Specification Section Reference: _____
  .1 Product Name: _____
  .2 Equipment Tag No.: _____

.2 Manufacturer/Supplier:
  .1 Name: _____
  .2 Address: _____
  .3 Website: _____
  .4 Product Representative:
    .1 Contact Name: _____
    .2 Telephone: _____
    .3 Email: _____
  .5 Proposed Substitution:
    .1 Model _____ Size _____ Type _____

.3 Reasons for substitution. Yes__ No__

.4 Statement on change to Contract Price. Yes__ No__

.5 Statement on change to Contract Time. Yes__ No__

.6 Statement verifying substitution will not affect performance or warranty. Yes__ No__

.7 Manufacturers literature. Yes__ No__

.8 Product samples (if applicable). Yes__ No__

.9 Comparison of physical properties and performance characteristics. Yes__ No__

.10 Maintenance services; sources of replacement parts/materials. Yes__ No__

.11 Life cycle costing savings. Yes__ No__

.12 Changes in the Work to accommodate the Substitution. Yes__ No__

.13 List three (3) recent Canadian projects where above equipment has been used. Provide Owner references.

Project Name	Location	Equip. Start-up/ Installation Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

Signed: _____ Contractor's Name: _____

Date: _____ Title: _____

END OF SECTION

1.1 SCHEDULE OF LABOUR RATES

.1 Prior to the first application for payment, submit for the Consultant's review a schedule of labour rates for all trades and classifications of trades, such as journeymen, apprentices, and foremen that will be employed in the Work. Provide a breakdown of payroll burden component of labour rates.

.2 Labour rates shall reflect the salaries, wages, and benefits paid to personnel in the direct employ of the Contractor, Subcontractors, and sub-Subcontractors, stated as hourly rates, that will be used when:

.1 preparing price quotations for Change Orders, and

.2 determining the cost of work attributable to Change Directives.

.3 Labour rates stated in the schedule of labour rates shall be consistent with rates that will actually be paid, and payroll burden costs that will actually be incurred, in the normal performance of the Work, during regular working hours. Labour rates shall not include any additional overhead and profit component.

.4 Where collective agreements apply, the labour rates shall not exceed those established by collective agreement.

.5 Obtain the Owner's written acceptance of the schedule of labour rates before submitting the first Change Order quotation.

.6 Accepted schedule of labour rates will be used solely for evaluating Change Order quotations and cost of performing work attributable to Change Directives.

.7 The Contractor may request amendments to the accepted schedule of labour rates if changes in the labour rates that will actually be paid, or payroll burden cost that will actually be incurred, in the normal performance of the Work can be demonstrated. Obtain the Owner's written acceptance of such changes.

1.2 SCHEDULE OF EQUIPMENT RATES

.1 Prior to the first application for payment, submit for the Consultant's review a schedule of equipment rates for Contractor owned Construction Equipment.

.2 Equipment rates shall reflect the rates that will be used when:

.1 preparing price quotations for Change Orders, and

.2 determining the cost of work attributable to Change Directives.

.3 Equipment rates stated in the schedule shall be consistent with local equipment rental market rates and shall not include any additional overhead and profit component.

.4 Schedule to include rates for equipment on standby. If Ontario Provincial Standard Specifications (OPSS) are used to develop equipment rates, standby rates shall be calculated using OPSS.MUNI 100.

.5 Obtain the Owner's written acceptance of the schedule of equipment rates before submitting the first Change Order quotation.

.6 Accepted schedule of equipment rates will be used solely for evaluating Change Order quotations and cost of performing work attributable to Change Directives.

.7 The Contractor may request amendments to the accepted schedule of equipment rates if changes in local equipment rental market rates can be demonstrated. Obtain the Owner's written acceptance of such changes.

1.3 VALUATION OF CHANGES BASED ON AGREED UNIT PRICES

.1 The Consultant may, at the outset of the Contract or at any other time, request the Contractor to submit unit prices anticipated to be required in valuing changes in the Work.

.2 The Contractor shall submit such unit prices promptly upon request.

.3 The unit prices shall be valid for a specified duration.

.4 The unit prices shall exclude all fees for overhead and profit and shall be subject to the percentage fees specified in Section 00800 Supplementary Conditions under GC 6.2 Change Order.

.5 The Consultant will evaluate the Contractor's quoted unit prices and, if accepted by the Owner in writing, the agreed unit prices shall be used to value subsequent proposed changes in the Work wherever they are applicable.

1.4 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE ORDERS

.1 Unless otherwise agreed, the adjustment of the Contract Price on account of a proposed change in the Work shall be based on a quotation for a fixed price increase or decrease to the Contract Price regardless of the Contractor's actual expenditures and savings.

1.5 CHANGE ORDER PROCEDURES

.1 Upon issuance by the Consultant to the Contractor of a proposed change in the Work, and unless otherwise requested in the proposed change or unless otherwise agreed:

- .1 Submit to the Consultant a fixed price quotation for the proposed change in the Work within five (5) days after receipt of the proposed change in the Work.
- .2 Provide a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:
  - .1 Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.
  - .2 Estimated product costs, including supplier quotations, estimated quantities and unit prices.
  - .3 Estimated construction equipment costs.
  - .4 Enumeration of all other estimated costs included in the price quotation.
  - .5 Estimated credit amounts for labour and products not required on account of the proposed change.
  - .6 Fees, not exceeding the applicable percentages for overhead and profit as specified in Section 00800.
  - .7 Where applicable, Subcontractor quotations, also including a detailed breakdown of all the above.

1.6 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE DIRECTIVES

.1 Unless the Owner and the Contractor reach an earlier agreement on the adjustment to the Contract Price by means of a Change Order that cancels the Change Directive, the adjustment in the Contract Price for change carried out by way of a Change Directive shall be determined as specified in the General Conditions of Contract after the change in the Work is completed.

1.7 CHANGE DIRECTIVE PROCEDURES

.1 If a Change Directive is issued for a change in the Work for which a proposed change was previously issued, but no Change Order has yet been signed, the Change Directive shall cancel the proposed change and any Contractor quotations related to that change in the Work.

.2 The Contractor will provide written notice to the Consultant and Owner prior to the start date of the Change Directive work.

1.8 SUPPLEMENTAL INSTRUCTIONS

.1 The Consultant may issue Supplemental Instructions to provide clarifications to the Contract Documents, provide additional information, or make minor variations in the Work not involving adjustment in the Contract Price or Contract Time.

.2 If the Contractor considers a Supplemental Instruction to require an adjustment in Contract Price or Contract Time, the Contractor shall promptly notify the Consultant and the Owner in writing and shall not proceed with any work related to the Supplemental Instruction pending receipt of a Change Order, a Change Directive, or, in accordance with the dispute resolution provisions of the General Conditions of Contract, a Notice in Writing of a dispute and instructions to proceed.

END OF SECTION

1.1 SCHEDULE OF VALUES

.1 A minimum of fifteen (15) working days prior to the first application for progress payment, submit for Consultant's review an initial schedule of values. Modify the initial schedule of values if and as requested by Consultant. Obtain Consultant's written acceptance of the initial schedule of values prior to the first application for progress payment.

.2 Together with the first and all subsequent applications for progress payment, submit updated versions of the schedule of values to indicate the values, to the date of application for progress payment, of work performed and Products delivered to Place of the Work.

.3 Provide a schedule of values that is sufficiently detailed and comprehensive to facilitate Consultant's evaluation of applications for progress payment at an appropriate level of detail. The work breakdown structure should consist of:

- .1 All material, labour, and equipment required as identified in the contract documents. To be identified by Division 01 through 17.
- .2 Division 01 should identify the following subheadings and costs at a minimum:
  - .1 Mobilization.
  - .2 Project Staffing.
  - .3 Site Trailer.
  - .4 Sanitation.
  - .5 Insurance.
  - .6 Bonding.
  - .7 Daily Clean
  - .8 Final Clean.
  - .9 Closeout Documentation.
  - .10 Commissioning.
  - .11 Commissioning Plan.
  - .12 Demobilization.

.4 All other divisions to separate activities into material, labour, large equipment supply and install, mobilization/demobilization, commissioning (as required), and closeout documentation.

.5 All forms of submittals as identified in the specifications and/or the design drawings will not be paid for in advance of the approved products being delivered to the Place of Work. Earlier payment of specialized equipment may be approved by Owner subject to prior submittal review and approval and at its discretion.

.6 The commissioning plan will be paid when the plan is 100% completed and agreed upon by the Contractor, Owner and Consultant. Contractor may not request interim payments for percentage of completeness.

.7 Application for progress payment for Products manufactured but not yet delivered to the Place of the Work will not be considered.

.8 Products delivered to the site significantly in advance of being required for installation in the orderly process of construction will not be eligible for payment, unless approved in writing by the Consultant prior to delivery.

.9 If requested by the Consultant, applications for progress payment from allowances shall be substantiated by copies of all invoices and statements from suppliers or Sub-Contractors furnishing products, etc., purchased under a cash allowance.

.10 The schedule of values must reflect Change Orders and allowances and include a breakdown that adds up to the current total Contract Price. The estimated value of Change Directives should also be included within the schedule of values but may be listed separately from the current total Contract Price.

.11 For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:

.1 Breakdown Amount: A dollar amount, including an appropriate pro rata portion of Contactor's overhead and profit.

.2 Performed to Date: The value of Work performed, and Products delivered to Place of the Work up to the date of the application for payment, stated as a percentage of the Contract Price and in dollars.

.3 Previously Performed: The value of Work performed, and Products delivered to the Place of the Work for which payment has been previously certified, stated in dollars.

.4 Current Period: The value of Work performed, and Products delivered to Place of the Work for which Contractor is currently applying for payment, stated in dollars.

.5 Balance to Complete: The value of Work not yet performed, and Products not yet delivered to Place of the Work, stated in dollars.

1.2 APPLICATION FOR PROGRESS PAYMENT AND CERTIFICATION

.1 The Consultant and Contractor will participate in a monthly pre-screening meeting to be held seven (7) working days prior to the submission of a Proper Invoice to review the particulars, details, information and documentation, including the breakdown of the schedule of values, and the proposed percentage of completion for each division of Work, which are proposed to constitute the basis of the Contractor's Proper Invoice, so as to assist the Contractor with the preparation and submission of its Proper Invoice on a monthly basis.

.2 An application for progress payment is to be submitted on the first Tuesday of the month following the month for which the invoice period pertains.

.3 Consultant will issue to Owner, no later than ten (10) calendar days after receipt of an application for progress payment a certificate for payment in amount applied for or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

.4 Include with each application for payment except the first, a statutory declaration in the form CCDC Document 9a, and such additional supporting documents as the Consultant may reasonably require.

1.3 CASH FLOW PROJECTION

.1 A minimum of ten (10) working days prior to submission of the first application for progress payment, provide a forecast of approximate monthly progress payments for each month of the Contract Time.

.2 Submit revised cash flow forecasts monthly and incorporate approved change orders and change directives.

1.4 WORKERS' COMPENSATION CLEARANCE

.1 Submit proof of workers' compensation clearance with each application for payment.

1.5 PAYMENT FOR PRODUCTS STORED OFF SITE

.1 Owner may, due to extraordinary circumstances and at Owner's sole discretion, make payments for Products delivered to and stored at a location other than Place of the Work, subject to:
  .1 a request submitted by Contractor in writing, with appropriate justification, and
  .2 whatever conditions Owner or Consultant may establish for such payments, as required to protect Owner's interests.

1.6 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 After issuance of certificate of Substantial Performance of Work:
  .1 Submit application for payment of holdback amount including:
    .1 Statutory Declaration.
    .2 Workers' Safety and Insurance Board clearance certificate.
    .3 Copy of publication notice declaring substantial performance.

.2 Consultant will issue a certificate for payment of holdback amount to the Owner no later than ten (10) working days following receipt of approved application for payment.

1.7 FINAL PAYMENT

.1 When the Consultant determines that the Work has been completed, the Contractor shall:
  .1 Submit application for final payment and application for release of finishing holdback amount including:
    .1 Declaration of Last Supply.
    .2 Statutory Declaration.
    .3 Workers' Safety and Insurance Board clearance certificate.

.2 Consultant will issue a final certificate for payment to the Owner no later than ten (10) working days following receipt of approved application for final payment and finishing holdback from the Contractor.

END OF SECTION

1.1 ADMINISTRATIVE

.1 The Consultant will schedule, chair and distribute the project meeting minutes.

.2 Meetings can be conducted on site if Contractor is following health and safety regulations for all AHJ's and government orders regarding social distancing and pandemic protocols.

.3 Meetings can be conducted using Microsoft Teams, Zoom or other similar virtual platform that has audio and visual capability.

.4 The Contractor is to preside at meetings.

.5 The Consultant shall record the minutes.

.6 The purpose of the meeting minutes is to document significant proceedings and decisions and identify actions by parties.

.7 The Consultant shall produce and issue meeting minutes electronically within seven (7) Calendar Days after each meeting to the Owner, Contractor, Consultant and all parties in attendance. Meeting minutes are to include all meeting documents reviewed at the meeting including project schedule, logs, etc. Within two (2) Working Days of receipt of the meeting minutes, the Consultant shall be notified of any noted errors and/or omissions. Consultant will revise the meeting minutes if deemed appropriate and return the revised meeting minutes to the Owner, Contractor, Consultant, and all parties in attendance.

.8 The Contractor shall be responsible for distribution of meeting minutes to their Subcontractors.

.9 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRE-CONSTRUCTION MEETING

.1 Promptly after Contract award, the Contractor shall establish the time and location of a construction start-up meeting to review and discuss administrative procedures and responsibilities. The Contractor shall notify the Consultant at least seven (7) Working Days before the meeting to discuss and resolve administrative procedures and responsibilities.

.2 Senior representatives of the Owner, Consultant, and Contractor, including Contractor's project manager and site superintendent, and major Subcontractors if requested, shall be in attendance.

.3 Agenda will include the following:

- .1 Project stakeholders including official representatives of the Owner, Contractor, Consultant, and Subconsultants.
- .2 Building permit status.
- .3 Project communication protocol.
- .4 Construction progress schedule.
- .5 Request for information process.
- .6 Change management process.

.7 Submittals schedule and procedures.
.8 Quality requirements including testing and inspection procedures.
.9 Billing and payment procedures.
.10 Construction facilities including temporary and existing utilities, cleaning and waste management, temporary barriers, enclosures, site controls, site safety, and site security.
.11 Work restrictions.
.12 Documents to be maintained at the site.
.13 Take-over procedures, acceptance, warranties and O&M manuals.
.14 Construction progress meeting frequency, meeting minutes, and meeting documents.
.15 Other business.

1.3 PROGRESS MEETINGS

.1 Schedule regular bi-weekly construction progress meetings for the duration of the Work. The Consultant shall prepare meeting agendas, chair the meetings, and record and distribute the minutes.

.2 Consultant shall record in the meeting minutes significant decisions and identify action items and action dates by attendees or the parties they represent.

.3 Ensure that Subcontractors (if requested) attend as and when appropriate to the progress of the Work.

.4 Agenda for each meeting shall include the following, as a minimum:
.1 Review of action item status from previous meeting.
.2 Construction progress schedule including review of Work progress since previous meeting.
.3 Field observations including any problems, difficulties or concerns.
.4 Submittals schedule and status of pending or outstanding items.
.5 Change management log and status of pending or outstanding items.
.6 Request for information log and status of pending or outstanding items.
.7 Site safety issues.
.8 Quality Control/Quality Assurance concerns.
.9 Billing and payment.
.10 Commissioning
.11 Other business.

1.4 COMMISSIONING MEETINGS

.1 Schedule regular monthly commissioning meetings three months before the start of commissioning.

.2 Meeting frequency shall be bi-weekly starting two months prior to the first commissioning activities, followed by weekly once the commission process has begun for a Facility. Additional meetings may be required.

.3 The Contractor Consultant shall prepare meeting agendas, chair the meetings, and record and distribute the minutes.

.4 The Commissioning Supervisor shall be present during Commissioning meetings and shall be available at all times during the commissioning period.

.5 Commissioning meetings to be held until all equipment and systems are fully commissioned and accepted by the Owner.

.6 Contractorshall record in the meeting minutes significant decisions and identify action items and action dates by attendees or the parties they represent.

.7 Ensure that Subcontractors, Suppliers, and Manufacturers (if requested) attend as and when appropriate to the progress of the Work.

.8 Agenda for each meeting shall include the following, as a minimum:
- .1 Review of action item status from previous meeting.
- .2 Commissioning schedule including review of Work progress since previous meeting.
- .3 Field observations including any problems, difficulties or concerns.
- .4 Submittals, change management, or request for information items related to commissioning activities.
- .5 Site safety issues.
- .6 Quality Control/Quality Assurance concerns.
- .7 Shutdowns or closure activities.
- .8 Other business.

1.5 SAFETY MEETINGS

.1 Prior to start of construction, organize and chair a Pre-construction Safety Meeting. Invite the Owner and the Consultant to attend this meeting and all subsequent Joint Health and Safety Committee meetings.

1.6 SPECIALIZED MEETINGS

.1 Schedule specialized meetings as needed for the duration of the Work. Specialized meetings shall be for specific topics that require a longer duration for discussion and cannot be accommodated in the progress meetings. This can include but not be limited to site issues, change management, schedule, quality, etc.

.2 The Consultant shall prepare meeting agendas, chair the meetings, and record and distribute the minutes.

.3 Consultant shall record in the meeting minutes significant decisions and identify action items and action dates by attendees or the parties they represent.

.4 Ensure that Subcontractors (if requested) attend as and when appropriate to the progress of the Work.

END OF SECTION

1.1 SUMMARY

.1 This Section specifies Contractor responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.

.2 The purpose of submitting progress schedules is to:
- .1 inform Owner and Consultant of actual progress versus planned progress, and
- .2 provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.2 CONSTRUCTION PROGRESS SCHEDULE

.1 Format and Content:
- .1 Prepare schedule in the form of a Critical Path Method (CPM) Gantt chart using Microsoft Project or equivalent approved by the Consultant.
- .2 Provide a work breakdown structure identifying key activities, work packages, and major milestones, including long lead deliveries of products or equipment, inspection and testing activities, preparation and review of mock-ups, shutdown or closure activities, and similar items, at a sufficient level of detail to effectively manage construction progress.
- .3 To contain the following information:
  - .1 Data Date.
  - .2 Project Name.
  - .3 Client Name.
  - .4 Schedule Name.
  - .5 Work Breakdown Structure with the minimum headings:
    - .1 Contract Tender and Award.
    - .2 Procurement (broken down by division and contract packages).
    - .3 Submissions (broken down by division and contract packages).
    - .4 Construction (broken down by phases, interior/exterior work areas and floor level).
    - .5 Commissioning.
    - .6 Closeout.
  - .6 Contract milestones.
  - .7 Activities identified as Owner allowances.
    - .1 Cash allowance authorization date by Owner.
    - .2 All activities related to cash allowance work.
  - .8 Activities for construction by Owner or Other contractors.
    - .1 Equipment or material submittals for site coordination purposes.
    - .2 Delivery dates to site of Owner/Other Contractor supplied materials and equipment.
    - .3 Installation dates of material and equipment that is by the Owner/Other Contractor
    - .4 Commissioning dates for equipment or systems that is by the Owner/Other Contractor.
  - .9 A complete listing of schedule activities needed to perform the Work.
  - .10 No activity durations shall exceed 10 days.
  - .11 Activity Attributes to be included: Activity Number, Activity Description, Original Duration, Actual Duration, Baseline Start and Finish, Actual Start and Finish, Predecessor, and Successor.
  - .12 Identify the critical path(s).

.2 Submission:
- .1 Submit initial schedule to Owner and Consultant within ten (10) Working Days after Contract award.

.2 Submit schedule via e-mail as .pdf and native files.

.3 Consultant will review format and content of initial schedule and request necessary changes, if any, within ten (10) Working Days after receipt.

.4 If changes are required, resubmit finalized initial schedule within five (5) Working Days after return of review copy.

.5 Submit updated progress schedule monthly (or as requested by the Consultant and Owner) to Owner and Consultant.

.6 The progress schedule submission is to include a Schedule Narrative indicating changes to actual and projected start and finish dates, activity relationships, critical path, float, and baseline comparison to current progress. The Schedule Narrative should include project risk items including but not limited to procurement, fabrication, deliveries, labour, change management, requests for information, etc.

.7 Construction schedule updates to include as a minimum:

.1 Data date to be identified.

.2 No dates shall be pushed by the data date.

.3 All activities that have not been completed by the data date are to be re-forecasted and updated in the schedule.

.4 All activities are to have predecessor(s) and successor(s) except for the first and last activity in the schedule and milestone activities.

.5 The project schedule logic is to be correctly linked to predecessor(s) and successor(s) in the order of build sequencing to properly identify the critical path(s) for the project.

.6 All completed activities to be identified as actualized. This includes start and finish dates.

.7 Identify the critical path(s).

.8 Approved changes that contain duration increases or decreases are to be incorporated into the schedule.

.9 Incorporate RFI's that impact the work.

1.3 4-WEEK LOOK AHEAD SCHEDULE

.1 Provide a 4-Week Look Ahead Schedule as requested by the Consultant to show all activities that started, progressed or finished one (1) week back and all activities starting or progressing within the next four (4) weeks.

.2 4-Week Look Ahead Schedule activities and dates are to align with the Construction Progress Schedule and Commissioning Schedule.

.3 The 4-Week Look Ahead Schedule is a planning aid and does not replace the requirement for the Construction Progress Schedule.

1.4 COMMISSIONING SCHEDULE

.1 Format and Content:

.1 Prepare schedule in the form of a Critical Path Method (CPM) Gantt chart using Microsoft Project or equivalent approved by the Consultant.

.2 The commissioning schedule is intended to be a separate document from the overall Construction Schedule, but shall be linked such that commissioning activities, deliverables and milestones are tied to the overall construction schedule, deliverables and milestones.

.3 Provide a work breakdown structure by Building and system identifying activities, sequence of activities, interrelationships, and party responsibilities including major milestones, long lead deliveries of products or equipment, inspection and testing activities, shutdown or closure activities, and similar items, at a sufficient level of detail to effectively manage the commissioning

progress.

.4 To contain the following information:
- .1 Data Date.
- .2 Project Name.
- .3 Client Name.
- .4 Schedule Name.
- .5 Work Breakdown Structure with the minimum headings:
  - .1 Submissions (broken down by division and contract packages).
    - .1 Equipment Fabrication
    - .2 Equipment Delivery
  - .2 Building Name.
    - .1 Building System Name.
    - .1 Testing and Inspection.
      - .1 Factory Witness Testing.
      - .2 Functional testing for each piece of equipment.
      - .3 Preliminary balancing.
      - .4 Control system start-up tests.
      - .5 Control system detail verification of sequence of operation where automatic control and logic is included in Contractor scope.
      - .6 Functional verification procedures and reports.
      - .7 Performance Testing procedures and reports.
    - .2 Balancing.
      - .1 Preliminary.
      - .2 Final.
    - .3 Training and instruction of Owner operational staff.
    - .4 Seasonal testing/balancing/commissioning.
    - .5 Operation and Maintenance Manuals
  - .3 Facilities 14 Day Performance Tests.
- .6 Contract milestones.
- .7 Activities for construction by Owner or Other contractors.
  - .1 Equipment or material submittals for site coordination purposes.
  - .2 Delivery dates to site of Owner/Other Contractor supplied materials and equipment.
  - .3 Installation dates of material and equipment that is by the Owner/Other Contractor
  - .4 Commissioning dates for equipment or systems that is by the Owner/Other Contractor.
- .8 A complete listing of schedule activities needed to perform the Work.
- .9 No activity durations shall exceed 10 days.
- .10 Activity Attributes to be included: Activity Number, Activity Description, Original Duration, Actual Duration, Baseline Start and Finish, Actual Start and Finish, Predecessor, and Successor.
- .11 Identify the critical path(s).

.2 Submission:
- .1 Submit initial commissioning schedule to Owner and Consultant twelve (12) weeks prior to any commissioning activities.
- .2 Submit schedule via e-mail as .pdf and native files.
- .3 Consultant will review format and content of initial commissioning schedule and request necessary changes, if any, within ten (10) Working Days after receipt.
- .4 If changes are required, resubmit finalized initial commissioning schedule within five (5) Working Days after return of review copy.
- .5 Submit updated commissioning schedule monthly (or as requested by the Consultant and Owner) to Owner and Consultant.

.6 The commissioning schedule submission is to include a Schedule Narrative indicating changes to actual and projected start and finish dates, activity relationships, critical path, float, and baseline comparison to current progress. The Schedule Narrative should include project risk items including but not limited to procurement, fabrication, deliveries, labour, change management, requests for information, etc.

.7 Commissioning schedule updates to include as a minimum:

.1 Data date to be identified.

.2 No dates shall be pushed by the data date.

.3 All activities that have not been completed by the data date are to be re-forecasted and updated in the schedule.

.4 All activities are to have predecessor(s) and successor(s) except for the first and last activity in the schedule and milestone activities.

.5 The project schedule logic is to be correctly linked to predecessor(s) and successor(s) in the order of build sequencing to properly identify the critical path(s) for the project.

.6 All completed activities to be identified as actualized. This includes start and finish dates.

.7 Identify the critical path(s).

.8 Approved changes that contain duration increases or decreases are to be incorporated into the schedule.

.9 Incorporate RFI's that impact the work.

1.5 SUBMITTALS SCHEDULE

.1 Format and Content:

.1 Prepare schedule identifying all required Shop Drawing, Product data, and sample submissions, including samples required for testing.

.2 Prepare schedule in electronic format as identified in Section 01320A.

.3 Provide a separate line for each required submittal, organized by Specifications section names and numbers, and further broken down by individual products and systems as required.

.4 For each required submittal, show planned earliest date for initial submittal and latest date for return of reviewed submittal without causing delay.

.5 For each required submittal, show fabrication duration, order date, and planned delivery date.

.6 Allow time in schedule for resubmission of submittals, should resubmission be necessary.

.2 Submission:

.1 Submit initial schedule to Consultant within ten (10) Working Days after Contract award.

.2 Submit schedule via e-mail as .pdf and native files.

.3 Consultant will review format and content of initial schedule and request necessary changes, if any, within ten (10) Working Days after receipt.

.4 If changes are required, resubmit finalized schedule within five (5) Working Days after return of review copy.

.5 Submit updated submittals schedule bi-monthly to Owner and Consultant.

1.6 SCHEDULE MANAGEMENT

.1 A schedule submitted as specified and reviewed by Consultant shall become the baseline schedule and shall be used as the baseline for updates.

.2 At each regular progress meeting, review and discuss current construction progress and submittals schedules with Consultant and Owner, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path.

.3 Activities considered behind schedule are those with start or completion dates later than the dates

shown on the baseline schedule.

.4 The project substantial completion date may only be changed by contract change order.

.5 Time extensions presented by the Contractor in the monthly update of the construction schedule that is not approved by Change Order by the Owner is subject to the Contractor providing a mitigation plan to realign the project with the contract time for the Work. This includes but is not limited to all necessary efforts such as overtime, additional labour resources, transportation premiums, expedited fabrication for material/equipment, night work, and weekend work.

1.7 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

.1 Obtain from Consultant an electronic copy of the construction Drawings for the purpose of creating as-built drawings. Record information in electronic form, clearly identifying as-built deviations from the originally obtained construction Drawings.

.2 Clearly label each drawing as “AS-BUILT DRAWING”. Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.3 Record actual construction including:

- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by Change Orders and Supplemental Instructions
- .6 References to Shop Drawings, where Shop Drawings show more detail.

1.8 PROGRESS PHOTOGRAPHS AND VIDEOS

.1 Arrange for digital photography to document and provide a photographic record of the progress of the Work.

.2 Identify each photograph by project name and date taken.

.3 Submission: Submit .jpg format files in standard resolution via e-mail monthly with application for payment. All items requested for payment shall be included.

.4 Do not use progress or any other Project photographs or videos for promotional purposes without Owner’s written consent.

END OF SECTION

Project:											
Contractor:											
Date:											
Contractor Submission No.	Rev. No.	Specification Section	Subsection	Description	Contractor Submission Date	Consultant Return Date	Status	Order Date	Fabrication Duration	Planned Delivery Date	Actual Delivery Date

1.1 SUBMITTAL REVIEW DEFINITIONS

.1 The following terms shall bear the noted meaning in relation to the review of submittals by the Consultant:

.1 Reviewed: Contractor need take no further action and may order the product(s) or equipment. The document is ready for inclusion in the Operation and Maintenance Manual (O&M).

.2 Reviewed as Noted (Resubmission Not Required): Contractor shall incorporate the comments marked on the “reviewed” submittal by the Consultant. The Contractor shall promptly notify the Consultant if any of the comments noted cannot be incorporated with an explanation. The Contractor may only order the product(s) or equipment using a clean updated copy of the submittal which incorporates all of the Consultant’s comments, and the document may be incorporated into the O&M.

.3 Reviewed as Noted (Resubmission Required): Contractor shall incorporate the comments marked on the “reviewed” submittals by the Consultant and submit new copies of the submittals to show compliance with the Contract Documents. Contractor is not to order the product(s) or equipment until the Consultant returns the document “Reviewed” or “Reviewed as Noted (Resubmission Not Required).

.4 Revise and Resubmit: The submittal contains multiple errors and is not compliant with the Contract Documents. Contractor to submit new copies of the submittals revised to show compliance with the Contract Documents. The Contractor is not to order the product(s) or equipment until the Consultant returns the document “Reviewed” or “Reviewed as Noted (Resubmission Not Required).

1.2 ADMINISTRATIVE

.1 Submit to Consultant specified submittals listed for review. Submit promptly and in orderly sequence to not cause a delay in the Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time or for Product substitutions or other deviations from the Drawings and Specifications.

.2 The Contractor shall deliver submittals and review comment sheets to the Consultant by email or by an alternative electronic delivery method provided by Contractor. If the Contractor intends to use an alternative electronic delivery method it shall be conditional upon approval of such alternative method by the Consultant (which may be withheld at the Consultant’s discretion) and must include a method for promptly notifying the Consultant of new submittals by email.

.3 All submittals are to be accompanied by a Contractor transmittal summarizing the contents of the submittal.

.4 The Contractor is responsible for identifying the order of priority of submittals pending Consultant Review in order to prevent any delays related to ordering of products or equipment to meet the Contract Time.

.5 Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.

.6 Present shop drawings, product data, and samples in SI Metric units.

.7 Verify field measurements and affected adjacent Work is coordinated.

.8 Submit shop drawings stamped and signed by professional engineer registered or licensed in the

Province of Ontario, Canada as required.

.9 Review submittals, provide verified field measurements where applicable, and affix Contractor's review stamp prior to submission to Consultant. The Contractor's review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the Work and Contract Documents.

.10 Notify Consultant, in writing at time of submission, if the submittal is a deviation from the Contract Documents. If the submission has not been previously accepted by the Consultant as an approved deviation, then the document will be returned "Not Reviewed".

.11 Do not propose Substitutions or deviations from Contract Documents via Shop Drawing, Product data and sample submittals. Refer to Section 01250 Substitution Procedures.

.12 Reproduction of construction Drawings to serve as background for Shop Drawings is not permitted. If construction Drawings are used for this purpose, remove references to Consultant.

.13 Keep one (1) reviewed copy of each submission on site.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Indicate Products, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work.

.2 Where Products attach or connect to other Products, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to Drawings, Specifications and other already reviewed Shop Drawings.

.3 Accompany submittals with a transmittal information including:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification of each submittal item and quantity.
- .5 Specification Section.
- .6 Location of equipment.
- .7 Other pertinent data.

.4 Shop Drawing submittals shall include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, date, and signature of Contractor's authorized representative responsible for Shop Drawing review, indicating that each Shop Drawing has been reviewed for compliance with Contract Documents and, where applicable, that field measurements have been verified.
- .5 Details of appropriate portions of the Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.

.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Equipment/Device Tag No., if applicable.
.11 Relationships to other parts of the Work.

.5 Product data submittals shall include material safety data sheets (MSDS) for all controlled Products.

.6 Submit manufacturers storage, installation, and start-up instructions with shop drawings.

.7 Submit electronic copy of Shop Drawings where specified in the technical Specifications.

.8 Submit electronic copy of Product data sheets or brochures where specified in the technical Specifications.

.9 Where a submittal includes information not applicable to the Work, clearly identify applicable information and strike out non-applicable information.

.10 Supplement standard information to include details applicable to Project.

.11 Do not proceed with any component of the Work nor provide Products without reviewed shop drawings being accepted and returned to the Contractor. Should Work commence, or Products be procured prior to Contractor’s receipt of reviewed shop drawings, the Contractor shall be liable for all corrections and costs incurred.

.12 Allow ten 10 days for Consultant's review of each submittal and incorporate in submittals schedule specified in Section 01320 – Construction Progress Documentation. Allow additional five (5) Working Days where Subconsultant or commissioning agent review is required.

.13 If upon Consultant’s review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of Work may proceed.

.14 If upon Consultant’s review significant errors or omissions are discovered, a so noted copy will be returned for correction and resubmission. Do not commence fabrication or installation.

.15 Consultant’s notations on submittals are intended to ensure compliance with Contract Documents and are not intended to constitute a change in the Work requiring change to the Contract Price or Contract Time. If Contractor considers any Consultant’s notation to be a change in the Work, promptly notify Consultant.

.16 Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the Work proceeds. Illustrate all revisions from previous submissions by highlighting or bubbling the changes. When resubmitting, notify Consultant in writing of any revisions other than those requested by Consultant.

1.4 SAMPLES

.1 Submit samples for Consultant’s review in duplicate where specified in the technical Specifications. Label samples as to origin, Project name, and intended use.

.2 Deliver samples prepaid to Consultant's business address.

.3 Notify Consultant in writing, at time of submission, of any deviations in samples from requirements of Contract Documents.

.4 Where a required colour, pattern or texture has not been specified, submit full range of available Products.

.5 Consultant selection from samples is not intended to change Contract Price or Contract Time. If a selection would affect the Contract Price or Contract Time, notify Consultant in writing prior to proceeding with the Work.

.6 Resubmit samples as required by Consultant to comply with Contract Documents.

.7 Reviewed and accepted samples will establish the standard against which installed Work will be reviewed.

1.5 MOCK-UPS

.1 Erect mock-ups in accordance with Section 01430 - Quality Requirements.

END OF SECTION

PROJECT:	**DATE: ……**
	SHOP DRAWING NO: ……
CONTRACT NO:	**REVISION: ……**
JLR PROJECT NO:	**SPECIFICATION SECTION: ……**
	TAG NO: ……

GENERAL CONTRACTOR:	**SUBCONTRACTOR:**
……	……
Address:	**Address:**
……	……
……	……
……	……

EQUIPMENT I.D.: ……

DESCRIPTION: ……

INSTALLATION LOCATION: ……

MANUFACTURER: ……

MODEL: ……

LIST DEVIATIONS FROM SPECIFICATION:

……

……

……

……

Site installation requirements reviewed by Contractor: **YES** ☐ **NO** ☐

Related subcontractors advised:

Mechanical ☐

Electrical ☐

Controls and Instrumentation ☐

Other: …… ☐

1.1 SCOPE

.1 This section provides the structural engineering data for seismic restraint design of the Operational and Functional Components for this project.

1.2 DEFINITIONS

.1 Operational and Functional Components (OFCs): non-structural building components, including architectural finishes, building service components (mechanical, plumbing, electrical and telecommunications) and building contents.

.2 Importance Categories for Buildings: buildings and their respective OFCs are defined by the Ontario Building Code 2012.
- .1 For seismic design, the importance categories for buildings are defined as Normal, High and Post-Disaster.

.3 Performance Objective Category:
- .1 Life Safety - minimum level performance objective.
- .2 Immediate/continued occupancy - allows for the building to be safe for occupancy immediately after being subjected to the design seismic ground motion, however the building need not be as fully operational and functional as prior to the earthquake (typically high importance structures such as schools or other buildings intended for use as emergency reception centres).
- .3 Functionality – OFC’s essential to the functioning and operation of the building shall be able to withstand damage and remain in service when subjected to design seismic ground motions.

1.3 REFERENCES

.1 Canadian Standards Association (CSA):
- .1 CSA S832-14 Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.
- .2 CSA A23.3-14 Design of Concrete Structures.
- .3 CSA B44-19 Safety Code for Elevators and Escalators.
- .4 CAN/CSA-S16-14 Limit States Design of Steel Structures.
- .5 CSA S37-18 Antennas, Towers and Antenna Supporting Structures.
- .6 CSA S304.1-14 Design of Masonry Structures.

.2 American Concrete Institute (ACI):
- .1 ACI 355.2-19 Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary.
- .2 ACI 355.4-20 Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary.

.2 American Society of Civil Engineers/Technical Council of Lifeline Earthquake Engineering (ASCE/TCLEE):
- .1 Methods of Achieving Improved Seismic Performance of Communications Systems (A. Tang and A.J. Schiff, Eds.) ASCE/TCLEE Monograph No. 10, 1996.

.3 American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.) (ASHRAE):
- .1 A Practical Guide to Seismic Restraint, Second Edition 2012.

.4 American Society of Mechanical Engineers (ASME International):

.1 ASME A17.1-2007 Safety Code for Elevators and Escalators.

.5 American Society for Testing and Materials (ASTM International):
.1 ASTM C635-04 Standard Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
.2 ASTM E580-[14] Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Moderate Seismic Restraint.

.6 Ceilings and Interior Systems Construction Association (CISCA):
.1 Guidelines for Seismic Restraint for Direct-Hung Suspended Ceiling Assemblies, 2004.

.7 Electrical Contractors Association of British Columbia (ECABC):
.1 Seismic Restraint Manual Guidelines for Electrical Systems, 2015.

.8 Earthquake Engineering Research Institute (EERI):
.1 EERI 99-01 Lessons Learned Over Time, Volume 1, “Re-examining the Performance of Roll-Up Garage Doors in Fire Stations in Recent California Earthquakes.”

.9 Federal Emergency Management Agency (FEMA):
.1 FEMA 273-1997 (Superseded by FEMA 356) NEHRP Guideline for the Seismic Rehabilitation of Buildings.
.2 FEMA 356-2000 Pre-Standard and Commentary for the Seismic Rehabilitation of buildings.

.10 Institute of Electrical and Electronics Engineers (IEEE):
.1 IEEE 693-1997 IEEE Recommended Practices for Seismic Design of Substations.

.11 National Fire Protection Association (NFPA):
.1 NFPA 13-2002 Installation of Sprinkler Systems.

.12 National Research Council of Canada (NRCC):
.1 Guidelines for Seismic Evaluation of Existing Buildings, 2005.
.2 National Building Code of Canada, 2020.
.3 National Fire Code of Canada, 2020.
.4 National Plumbing Code of Canada, 2020.
.5 User’s Guide – NBCC 2015, Structural Commentaries (Part 4).

1.4 QUALIFICATIONS

.1 Design and inspection of seismic restraint of OFCs to be carried out by a qualified engineer licensed in the Province of Ontario. Engineer to have a minimum of five years’ experience in the design of lateral restraint for specific discipline of OFCs.

1.5 SUBMITTALS

.1 Submittals in accordance with Division 01.

.2 Shop Drawings:
.1 Submit shop drawings sealed by a Professional Engineer registered in the Province of Ontario. Shop drawings shall include the following as a minimum:
.1 Summary design calculations for each OFC or component including the following parameters:
.1 V_p – Specified lateral earthquake force;
.2 $S_{(0.2)}$ – design spectral acceleration value at a period of 0.2s;

.3 I_e – Earthquake Importance Factor;
.4 S_p – including Category in Table 4.1.8.18 and reduced Rp value where applicable based on anchorage type and embedment
.5 W_p – weight of component or element
.2 Shop drawings for each type and device of seismic restraint.
.3 Layout drawings for location of devices.
.4 Anchor forces, anchorage/fastener details and location of anchorages to structure.

.3 Certifications:
.1 Certification of Seismic Restraint System for each OFC, confirming that installation meets Building Importance Category and performance criterion specified herein.
.2 Certification from OFC equipment manufacturer confirming that OFC equipment is compliant with the specified seismic provisions.

.4 Installation:
.1 The Contractor is to provide a letter sealed by the Professional Engineer responsible for preparing the shop drawings confirming that the seismic restraints have been installed in conformance with the design.

.5 Maintenance data:
.1 Including monitoring requirements for incorporation into maintenance manuals.

1.6 DESIGN CRITERIA

.1 Seismic restraint design for OFC's to meet Ontario Building Code 2012, National Fire Code 2020] and National Plumbing Code.

.2 Performance Category – Functionality.

.3 Seismic loading:
.1 Equivalent lateral static force acting on OFC and respective connections to be in accordance with the requirements of Clause 4.1.8.18 of the OBC.
.2 Seismic Site Class C.
.3 Sa(0.2, X_C) = 0.814 (Casselman, Ontario).
.4 Sa(1.0, X_C) = 0.246 (Casselman, Ontario).
.5 Importance Category: Post-Disaster Ie = 1.5.
.6 Cp, Ar and Rp as per OBC Table 4.1.8.18 with modifications to Rp based on the selected anchorage type:
.1 Rp = 1.0 for non-ductile connections, Rp = 1.5 for shallow post-installed or cast-in-place connections.

.4 Where appropriate, OFCs to be provided with sufficient gap between adjacent OFC equipment and/ or flexible connections between system elements to ensure assumed design behaviour is achieved and OFC equipment does not collide during a seismic event.

.5 Where identified in specific specification sections, OFC equipment or items noted as being required for immediate/continued occupancy to be seismically restrained to ensure continued operation immediately after a design seismic event.

.6 OFCs and seismic restraints to be provided with a Certification of Performance. This may include

certification of equipment, attesting to a seismic resistance qualification for the equipment.

.7 Seismic restraint attachments to meet the following as a minimum standard:

.1 Attachments and supports that transfer seismic forces to be constructed of materials suitable for application and to be designed and constructed in accordance with nationally recognized codes and standards.

.2 Attachments embedded in concrete and/or masonry to be suitable for cyclic and shock loads (Annex D of CSA A23.3 and ACI 355.2, ACI 355.4).

.3 Rod hangers for piping, ducting and cable trays to be considered seismic supports if the length of the hanger from the supporting structure is less than or equal to 300mm. Rod hangers not to be constructed so that rod is subjected to bending moments (CAN/CSA-S16).

.4 Seismic supports to be constructed so that support engagement is maintained in accordance with NBCC Clause 4.1.8.18.

.5 Power actuated devices not to be used for cyclic tension loads.

.6 Friction clips not to be used for anchorage attachment.

.7 Friction due to gravity loads shall not be considered to provide resistance to earthquake forces.

.8 Post-installed anchors to meet ACI 355.2, ACI 355.4 and/or be approved by the International Conference of Building Officials (ICBO).

.9 Drilled and grouted-in-place anchors for tensile load applications to use expansive cement or expansive epoxy grout.

.10 Supports to be specifically evaluated if weak-axis bending of cold-formed steel is used for seismic load path.

.11 Components mounted on vibration isolation systems to have a minimum of four integrated or independent omni-directionally acting snubbers. Seismic force to be calculated in accordance with the OBC or to be $2W_p$ minimum.

.8 Attachment of seismic restraint anchors to be limited to main structural elements including concrete slabs, concrete beams, metal deck and main steel beams. Building columns, open web steel joists, and secondary framing for walls not to be used for securing seismic restraint anchors.

END OF SECTION

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit site-specific Health and Safety Plan within five (5) working days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include as applicable to the Work:
- .1 Company policy statements (Health and Safety, Environmental, Violence and Harassment, Alcohol, Tobacco and Other Drugs, etc.).
- .2 Project Team and role and responsibilities.
- .3 Emergency contact.
- .4 Identification of daily and weekly health and safety paperwork to be completed and submitted by the Contractor and Trade Contractors.
- .5 Visitor sign in protocol.
- .6 Enforcement of Health and Safety and Environmental.
- .7 Site orientation protocol and frequency.
- .8 Personal protective equipment requirements.
- .9 Fall protection plan.
- .10 First aid.
- .11 Accident and incident reporting requirements.
- .12 Emergency response plan including procedures and evacuation plan.
- .13 Pandemic response and operating plan.
- .14 Hospital information.
- .15 Designated substances.
- .16 Other.

.2 Submit one (1) electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Consultant, Owner, and or authority having jurisdiction, as per their request.

.3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.4 Submit copies of incident and accident reports.

.5 Submit WHMIS SDS - Safety Data Sheets.

.6 Consultant and Owner review of Contractor’s site-specific Health and Safety plan should not be construed as approval and does not reduce the Contractor’s overall responsibility for construction Health and Safety.

1.2 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

.2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project

1.3 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:
- .1 Municipality of Casselman.
- .2 Ontario Clean Water Agency

.3 Neighbouring Residents
.4 Hydro Ottawa
.5 Enbridge Gas
.6 Conseil Scolaire de District Catholique de l”Est ontarien.

1.4 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

.3 The Contractor is responsible to take every reasonable precaution to protect the health and safety of workers including hazards posed by infectious disease. The costs associated with providing health and safety documentation, policies, procedures, training, personal protective equipment, signage, handwashing stations, sanitizer, products and labour for increased sanitation cleaning and sterilization, products and labour for increased site or trailer cleaning and sterilization, including all other requirements are by the Contractor.

.4 The Contractor is responsible for the costs associated with tools, site supplies, office supplies, elevating platforms, trailers, etc. as needed to maintain social distancing requirements as mandated by all authorities having jurisdiction.

.5 The Contractor is to report immediately to the site personnel, visitors, suppliers, Owner, Consultant and Others as needed if a worker advises of exposure or confirmed contact with COVID-19. The Contractor will provide a risk assessment and identify the proposed actions to be taken to reduce the risk of further contact and exposure to the virus and to protect the safety of the workers.

.6 The Contractor is responsible for all noted items and other COVID-19 health and safety practices established by the Ministry of Labour, all Public Health Authorities and applicable laws on the execution date of the Agreement.

1.5 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.6 UNFORESEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety Coordinator or Safety Officer and follow procedures in accordance with Acts and Regulations of Ontario having jurisdiction and advise Consultant verbally and in writing.

1.7 TREATMENT CHEMICALS AND VARIOUS OTHER POTENTIAL HAZARDS

.1 Be aware that various potential hazardous chemicals and materials are used in and are inherent to the sewage pumping process. In addition, various potential hazards such as sewage, methane gas, hydrogen sulfide confined spaces will be present. Refer to the Designated Substances Survey for other potential hazards,

.2 Prior to commencing work on-site, the Contractor shall meet with the Owner to familiarize himself with substances on-site, and location and requirements of WHMIS Data Sheets.

.3 The Contractor is responsible to determine all necessary precautions, establish its own safety plan, and train its workers.

1.8 HOT WORK PERMIT

.1 All contractors must have an established procedure in place requiring the issuance of a Hot Works Permit prior to engaging in any work involving open flames, sparks, or other activity that could cause combustion.

.2 Provide a copy of the Hot Works Permit procedures for the Consultant’s review.

1.9 HEALTH AND SAFETY COORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-coordinator. Health and Safety Co-coordinator must:

- .1 Have site-related working experience specific to activities associated with the Work.
- .2 Have working knowledge of occupational safety and health regulations.
- .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
- .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .5 Be on site during execution of Work and report directly to and be under direction of the site supervisor.

1.10 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Consultant.

1.11 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner.

.2 Provide Owner with written report of action taken to correct non-compliance of health and safety

issues identified.

.3 Owner may stop Work if non-compliance of health and safety regulations is not corrected.

1.12 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

END OF SECTION

1.1 REFERENCE STANDARDS

.1 "Reference standards" means consensus standards, trade association standards, guides, and other publications expressly referenced in Contract Documents.

.2 Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However, if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.

.3 Reference standards establish minimum requirements. If Contract Documents call for requirements that differ from a referenced standard, the more stringent requirements shall govern.

.4 If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Consultant for clarification.

1.2 INDEPENDENT INSPECTION AND TESTING AGENCIES

.1 Except as otherwise specified, Owner will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the Work.

.2 Retain and pay for inspection and testing that is for Contractor's own quality control or is required by regulatory requirements.

.3 Section 01210 Allowances specifies a cash allowance for independent inspection and testing services to be retained and paid for by Contractor. Cash allowance excludes any inspection and testing that is for Contractor's own quality control or is required by regulatory requirements.

.4 Employment of inspection and testing agencies by Contractor or Owner does not relieve Contractor from responsibility to perform the Work in accordance with Contract Documents.

.5 Allow and arrange for inspection and testing agencies to have access to the Work, including access to off site manufacturing and fabrication plants.

.6 For inspection and testing required by Contract Documents or by authorities having jurisdiction, provide Consultant and inspection and testing agencies forty-eight (48) hours minimum notice or as required to ensure timely notification in advance of required inspection and testing.

.7 Submit test samples required for testing in accordance with submittals schedule specified in Section 01320 Construction Progress Documentation.

.8 Provide labour, Construction Equipment, and temporary facilities to obtain and handle test samples on site.

1.3 INSPECTION AND TESTING AGENCY REPORTS

.1 For inspection and testing required by Contract Documents or by regulatory requirements, and performed by Contractor retained inspection and testing agencies, submit to Consultant copies of reports. Submit within five (5) days after completion of inspection and testing.

.2 For inspection and testing performed by Owner retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to Contractor.

1.4 MOCK-UPS

.1 Prepare mock-ups of Work as specified in the technical specification sections. If a mock-up location is not indicated in the Drawings or Specifications, locate where directed by Consultant. Issue Request for Information (RFI) to determine location.

.2 Modify mock-up as required until Consultant approval is obtained.

.3 Approved mock-ups establish an acceptable standard for the Work.

.4 Protect mock-ups from damage until the Work they represent is complete.

.5 Unless otherwise specified in the technical specification sections, approved mock-ups forming part of the Work may remain as part of the Work.

.6 Remove mock-ups only when the Work they represent is complete or when otherwise directed by Consultant.

END OF SECTION

1.1 TEMPORARY UTILITIES – GENERAL

.1 Provide temporary utilities as specified and as otherwise necessary to perform the Work expeditiously.

.2 Remove temporary utilities after use.

1.2 TEMPORARY WATER SUPPLY

.1 Arrange and pay for temporary supply of water required during construction.

.2 Arrange and pay for necessary water supply connections and disconnections.

.3 The Contractor must provide an adequate supply of potable water for decontamination showers during asbestos removal if applicable.

.4 Provide, install and maintain temporary reduced pressure backflow preventer where connecting to the municipal water supply. Connect to and use Owner's existing water supply for temporary use during construction, subject to existing available volume and pressure. and usage of Municipality water to be coordinated with and supervised by Municipality staff and OCWA.

1.3 TEMPORARY HEATING AND VENTILATION

.1 Arrange and pay for temporary heating and ventilation required during construction.

.2 Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters. Solid fuel salamanders are not permitted.

.3 Provide temporary heat for the Work as required to:

- .1 Facilitate progress of Work.
- .2 Protect the Work against dampness and cold.
- .3 Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored Products.
- .4 Maintain specified ambient temperatures and humidity levels for storage, installation and curing of Products.
- .5 After building is enclosed, maintain interior temperature of minimum ten (10) degrees C. Review technical sections for more stringent interior minimum heating requirements.

.4 Provide temporary ventilation for the Work as required to:

- .1 Prevent accumulations of fumes, exhaust, vapours, gases or other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.
- .2 Ensure that hazardous, noxious, or volatile substances do not migrate to Owner occupied spaces.
- .3 Ventilate temporary sanitary facilities.
- .4 New permanent building heating and ventilation systems may be used during construction, at

Contractor's option.

.1 Contractor shall pay utility costs resulting from the use of permanent systems.

.2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.

.3 Just prior to Substantial Performance of the Work, replace filters, clean equipment, and perform other required maintenance to ensure systems are in as near as new condition as possible.

.4 Ensure that systems manufacturers' warranties do not commence until the date of Substantial Performance of the Work or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under Contractor's warranty.

1.4 TEMPORARY ELECTRICAL POWER AND LIGHTING

.1 Arrange and pay for temporary power and lighting required during construction.

.2 New permanent building power and lighting systems may be used during construction, at Contractor's option. If used during construction:

.1 Contractor shall pay utility costs resulting from the use of permanent systems.

.2 Operate systems in a non-wasteful and energy efficient manner. Be responsible for any system damage.

.3 Just prior to Substantial Performance of the Work, replace lamps which have been used for more than 3 months.

.4 Ensure that systems manufacturers' warranties do not commence until the date of Substantial Performance of the Work or, if manufacturers' warranties do commence earlier when systems are put into use, arrange for necessary extension of manufacturers' warranties or provide equivalent coverage under Contractor's warranty. Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.

1.5 EXISTING BUILDING HEATING, VENTILATION, POWER, AND LIGHTING

.1 Existing building heating, ventilation, power, and lighting may be relied upon and used during construction.

1.6 FUEL SUPPLY

.1 Provide and pay for any temporary fuel required to accommodate testing.

1.7 TEMPORARY TELECOMMUNICATIONS

.1 Arrange and pay for temporary telecommunications as required during construction.

1.8 TEMPORARY BYPASS PUMPING SYSTEMS

.1 This Section provides the basis for furnishing all labour, supervision, equipment and materials, and perform all operations for the temporary bypassing of wastewater to facilitate the work within existing lagoon Cell #5.

.2 The project is anticipated to require temporary bypass pumping system to facilitate completion of the

works. The systems and their intent are generally listed below.

.1 The purpose of this bypass pumping system is to bypass existing lagoon Cell #5, and to allow work to occur for SAGR cells and berm separating SAGR/ modified Cell #5.

.2 The intercepted wastewater shall be discharged downstream of the existing lagoon Cell #5 at the existing discharge chamber that feeds the plant effluent pumping station.

.3 The Contractor will be responsible for maintaining the existing operational service level at all locations where temporary bypass pumping systems are required during construction.

.4 The temporary bypass pumping system may include, but is not limited to, installation and operation of bulkheads, plugs, hoses, piping, temporary manholes and/or sumps and pumps to maintain wastewater flows from Cell #4 into the existing effluent structure. Contractor shall be responsible for maintaining level in the existing effluent structure to avoid overflow. Owner will be responsible for operating existing effluent pumps to maintain level in the same effluent structure.

.5 The design, installation and operation of the temporary bypass pumping system shall be the Contractor's responsibility.

.6 Submittals and Approval

.1 Refer to Section 01340 – Shop Drawings, Product Data and Samples, for Submittals requirements.

.2 Provide a Temporary Bypass Pumping System Design Plan, prepared and sealed by a Professional Engineer licensed in the Province of Ontario.

.1 Provide an Emergency Spill Action Response Plan outlining procedures to address adverse weather and flooding risks. Each plan shall also include, but not be limited to, the following:

.2 Procedures for notification to the Town and the MECP.

.3 Mandatory regulatory reporting requirements.

.4 Plan for investigating the cause of the spill.

.5 Plan for preventing public exposure to the spill, including procedures for redirecting pedestrian and vehicular traffic away from the impacted area.

.6 Measures to be taken to mitigate the adverse effects of the spill on the natural environment.

.3 The Temporary Bypass Pumping System Design Plan shall include sufficient detail on the location, number, sizes and types of temporary manholes, sumps, pumps, hoses, piping and proposed tie-in locations to the pumping station forcemains. Each plan shall also include, but not be limited to, the following:

.1 Project information including the project name and pumping station location.

.2 Contact information for the Contractor's designated supervisor for the Temporary Bypass Pumping System, including 24 hour per day phone number(s).

.3 Staging area and schematic showing the arrangement and layout of the Temporary Bypass Pumping System. Indicate the length, size, material and location of the pump suction (where applicable) and discharge piping, temporary manhole and/or sump.

.4 Sewer plugging method, plug type and proposed location.

.5 Calculation for selection of bypass pump and pipe size, based on sewage flow, flow velocities and total dynamic head, including static lift, friction and fittings losses. Pump performance curve shall be plotted on system curve, with the operational range indicated. Where pumps are proposed to be equipped with variable frequency drives, indicate the pump speed and/or motor frequency corresponding to design flows.

.6 Pump manufacturer, numbers of pumps, model, sizes, capacities, and power requirements.

.7 Standby power generator capacity, site location, refueling requirements and/or restrictions.

.8 Any temporary equipment and piping anchors or supports, thrust blocks and/or discharge piping restraint types and locations.

.9 Proposed schedule and duration of operation of Temporary Bypass Pumping System.

.4 Lagoon upgrades bypass pumping:

.1 Pumping system to be capable of pumping between 50 to 139 L/s as required to facilitate lagoon upgrades in Cell #5 to match existing effluent pumping station rated capacity.

.5 Contractor responsible for reviewing existing documentation, contract documentation, and actual site conditions to confirm the exact flow and total dynamic head required for the design of Temporary Bypass Pumping Systems. The information provided herein is for the sole purpose of assisting with pricing at the time of Tender.

.6 Submit Temporary Bypass Pumping System Design Plan and Emergency Spill Action Response Plan for Owner and the Consultant review a minimum of four (4) weeks prior to intended use. Installation and testing of Temporary Bypass Pumping System shall not proceed until corresponding Temporary Bypass Pumping System Design Plan and Emergency Plan are reviewed and approved by Owner and the Consultant.

PART 2 – TEMPORARY PRODUCTS

2.1 TEMPORARY PUMPING SYSTEM EQUIPMENT AND MATERIALS

.1 This Section provides the basis for furnishing all labour, supervision, equipment and materials, and perform all operations for the temporary bypassing of wastewater at the Casselman Main Sewage Pumping Station.

.2 The purpose of temporary bypass pumping is to intercept wastewater at the pumping station and pump it into its associated forcemain in order to facilitate shutdown and isolation of the pumping station for construction of the upgrades.

.3 The Contractor will be responsible for maintaining the existing operational service level at the pumping station at all times during construction.

.4 The temporary bypass pumping system may include, but is not limited to, installation and operation of bulkheads, plugs, hoses, piping, temporary manholes and/or sumps and pumps to maintain wastewater flows at the pumping station, in order to prevent inlet sewer surcharging and/or overflows.

.5 The design, installation and operation of the temporary bypass pumping system shall be the Contractor's responsibility.

.6 Submittals and Approvals

.1 Refer to Section 01340 – Shop Drawings, Product Data and Samples, for Submittals requirements.

.2 Provide a Temporary Bypass Pumping System Design Plan, prepared and sealed by a Professional Engineer licensed in the Province of Ontario.

.3 Provide an Emergency Spill Action Response Plan outlining procedures to address adverse weather and flooding risks. Each plan shall also include, but not be limited to, the following:

.1 Procedures for notification to the Town and the MECP.

.2 Mandatory regulatory reporting requirements.

.3 Plan for investigating the cause of the spill.

.4 Plan for preventing public exposure to the spill, including procedures for redirecting pedestrian and vehicular traffic away from the impacted area.

.5 Measures to be taken to mitigate the adverse effects of the spill on the natural environment.

.4 The Temporary Bypass Pumping System Design Plan shall include sufficient detail on the location, number, sizes and types of temporary manholes, sumps, pumps, hoses, piping and

proposed tie-in locations to the pumping station forcemains. Each plan shall also include, but not be limited to, the following:

.1 Project information including the project name and pumping station location.
.2 Contact information for the Contractor's designated supervisor for the Temporary Bypass Pumping System, including 24 hour per day phone number(s).
.3 Staging area and schematic showing the arrangement and layout of the Temporary Bypass Pumping System. Indicate the length, size, material and location of the pump suction (where applicable) and discharge piping, temporary manhole and/or sump.
.4 Sewer plugging method, plug type and proposed location.
.5 Calculation for selection of bypass pump and pipe size, based on sewage flow, flow velocities and total dynamic head, including static lift, friction and fittings losses. Pump performance curve shall be plotted on system curve, with the operational range indicated. Where pumps are proposed to be equipped with variable frequency drives, indicate the pump speed and/or motor frequency corresponding to design flows.
.6 Pump manufacturer, numbers of pumps, model, sizes, capacities, and power requirements.
.7 Standby power generator capacity, site location, refueling requirements and/or restrictions.
.8 Any temporary equipment and piping anchors or supports, thrust blocks and/or discharge piping restraint types and locations.
.9 Proposed schedule and duration of operation of Temporary Bypass Pumping System.

.5 The existing pumping station has a maximum design peak flow of 118 L/s. The existing forcemain is a 400 mm diameter, with a length of approximately 1800 m. Contractor to note that sewage flows are highly variable, dependent on time of day, time of year and weather patterns.

.6 Submit Temporary Bypass Pumping System Design Plan and Emergency Spill Action Response Plan for Owner and the Consultant review a minimum of four (4) weeks prior to intended use. Installation and testing of Temporary Bypass Pumping System shall not proceed until corresponding Temporary Bypass Pumping System Design Plan and Emergency Plan are reviewed and approved by Owner and the Consultant.

2.2 ACCEPTABLE BYPASS PUMPING EQUIPMENT SUPPLIERS

.1 Atlas Dewatering Corporation.

.2 Aquatech Dewatering Company Inc.

.3 Or approved equivalent.

PART 3 – TEMPORARY SYSTEM EXECUTION

3.1 INSTALLATION AND OPERATION

.1 Maintain existing sewage conveyance service levels at all times during lagoon discharge period. Prevent sewage surcharging or overflow onto streets, yards, ditches, storm sewers or waterways. Contractor shall take all necessary steps to prevent flooding of public and/or private property.

.2 Promptly notify Owner of any accidental sewage spill or overflow event. Contractor shall be held financially responsible for all damages incurred from sewage overflows or spills caused by failure or malfunction of the Temporary Bypass Pumping System or any of its associated components.

.3 Locate all existing sanitary sewers and forcemains and provide all necessary labour, material, equipment and operations to bypass pumping station(s) and pump directly to forcemain. As minimum, a site supervisor from the acceptable bypass equipment supplier shall be on-site to assist in system assembly and successful commissioning of the temporary bypass system.

.4 Provide 24 hours per day, 7 days per week automated controls, monitoring and alarming functions for the Temporary Bypass Pumping System. Should automated controls and monitoring functions be unavailable, provide continuous on-site supervision for the duration of bypass pumping operations.

.5 Maintain existing site access and access to adjacent properties. Provide ramps, steel plates or other temporary provisions to facilitate vehicular traffic over above-grade hoses or piping.

.6 Do not damage, alter or remove any existing sanitary sewer infrastructure for purpose of installing the Temporary Bypass Pumping System, without the Owner and the Consultant's approval. Repair or reinstate damaged or altered sanitary sewer infrastructure at no additional cost to the Owner.

.7 Upon completion of Temporary Bypass Pumping System operations, drain all temporary piping into an adjacent manhole or wet well. Flush all pumps, piping and hoses with clean water.

3.2 SCHEDULING

.1 Contractor to prepare a schedule of construction activities associated with the implementation and operation of the Temporary Bypass Pumping and Aeration System, including timing and durations for equipment installation, start-up, testing and commissioning, conducted in accordance with Section 01021 – Equipment Testing, Commissioning and Operator Training.

.2 Identify any bypass pumping and aeration systems tasks not included in the Temporary Bypass Pumping/ Aeration System Design Plan, and obtain Owner and Consultant approval prior to proceeding.

3.3 PAYMENT

.1 Work performed under this section will be paid as a lump sum, including full compensation for all labour, equipment, materials, transportation and incidentals required to implement and operate the Temporary Bypass Pumping System broken down as follows:

.1	Reviewed bypass pumping plan and commissioned installation	20%
.2	Pro-rated monthly payments for the duration of contract	70%
.3	Demobilization of bypass pumping system	10%

END OF SECTION

1.1 CONSTRUCTION FACILITIES – GENERAL

.1 Provide temporary construction facilities as necessary for performance of the Work and in compliance with applicable regulatory requirements.

.2 Maintain temporary construction facilities in good condition for the duration of the Work.

.3 Remove temporary construction facilities from Place of the Work when no longer required.

1.2 SITE LOGISTICS PLAN

.1 Prepare a site logistics plan indicating proposed location and dimensions of area to be fenced including gate locations. The plan should include, but not be limited to, the Contractor, Subcontractor, Consultant trailers, travel path of construction vehicles, parking lot, temporary sanitary facilities, garbage bins, security measures, crane location including swing radius, storage and laydown areas, temporary utilities, and all other relevant information to complete the plan. If the site logistics plan is subject to change during the project, provide phased site logistics plan with planned dates for site changes.

1.3 CONSTRUCTION PARKING

.1 The contractor shall ensure that all construction related parking is within project site or at designated off-site areas, as agreed to with the owner.

.2 Long-term parking will not be permitted at Place of Work.

1.4 VEHICULAR ACCESS

.1 Provide and maintain adequate access to Place of the Work.

.2 Existing roads at Place of the Work may be used for access to Place of the Work, provided Contractor assumes responsibility for any damage caused by construction traffic, and prevents or promptly cleans up any mud tracking or material spillage.

.3 Maintain access to property including overhead clearances for use by emergency response vehicles.

.4 The Contractor shall ensure that access to site hydrants and fire access entrances are always maintained and free of obstruction.

.5 Due to the volume of construction that is anticipated and the ongoing facility operations, maintaining traffic flow into, around, and out of project site will be critical. Employ traffic control personnel and measures, as required, in order to ensure traffic always continues to flow safely through the project site.

.6 Provide signage and maintain competent, trained signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform the Work in a safe and controlled manner.

.7 The Contractor may not park, store, or operate equipment or material within the public right-of-way

except for the work specifically indicated to take place within the right-of-way.

.8 The Contractor shall ensure that site deliveries necessary for the operation of the facility are not restricted by the Work and that facility vehicles always have site access. Always maintain access in order to permit these deliveries to take place.

.9 Construction deliveries are to be restricted to normal working hours and shall always be via the existing site entrance.

.10 The Contractor shall ensure that all vehicles used on-site are properly maintained, licensed, and insured.

1.5 SITE OFFICES

.1 Provide a temperature controlled and ventilated office, with suitable lighting, of sufficient size to accommodate Contractor's Site Superintendent and construction staff.

.2 Consultant's Site Trailer:

- .1 Provide temporary office trailer for Consultant. Trailer to be new or in good condition.
- .2 Provide a 35-70m2 temporary office trailer with metal stairs, windows, and a minimum of one lockable door dependent on trailer size.
- .3 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature. Trailer to be skirted.
- .4 Interior finishes to include acoustic ceiling tile or gypsum ceiling, paneled walls, and vinyl tile flooring.
- .5 Install electrical lighting system to provide min 750 lx using surface mounted, shielded commercial fixtures with 10 % upward light component.
- .6 Provide private washroom facilities adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
- .7 Equip office with 2 desks and 2 office desk chairs, 1 x 2 m / 3' x 6' table, four (4) chairs, 3m / 10' of shelving 300 mm / 12" wide, one (1) 3-drawer filing cabinet, one (1) plan rack and one (1) coat rack, shelf, paper towels, waste baskets, first aid kit, fire extinguisher, and water cooler.
- .8 All equipment provided will be new or like new in appearance and condition. Any equipment not meeting this requirement will be removed at Consultant's instruction and replaced with satisfactory equipment.
- .9 Provide water service to deliver and collect water bottles and to maintain water cooler. Cooler to be capable of producing both hot and cold water. Paper cup dispenser and cups to be provided.
- .10 Maintain trailer in clean condition.
- .11 Contractor to arrange and pay for installation and ongoing charges for:
  - .1 High speed internet.
  - .2 Telephone.
  - .3 Printer/fax/scanner/copier machine with black and white and colour capability for 8 ½ x 11 inch and 11 x 17 inch paper. Comes with automatic document feeder, duplex printing/copying and standard tray configuration. Maintenance contract with provider to be included. All consumables including but not limited to paper, ink, and toner to be included.
  - .4 Long-distance charges.

1.6 TEMPORARY SANITARY FACILITIES

.1 Provide sanitary facilities for workers.

.2 Do not use permanent washroom facilities during construction.

.3 Keep sanitary facilities clean and fully stocked with the necessary supplies.

1.7 FIRE PROTECTION

.1 During the entire construction period, provide fire extinguishers in each shed, temporary office, construction equipment, as well as in other locations reasonably required, and all other fire protection necessary to protect the project and to comply with the requirements of insurance underwriters for the project and local, provincial, and federal authorities.

1.8 SECURITY

.1 Where security has been reduced by work of the Contract, provide temporary means to maintain security.

END OF SECTION

1.1 REQUEST FOR CUTTING, PATCHING AND REMEDIAL WORK

.1 Submit written request in advance of cutting, coring, or alteration which affects or is likely to affect:
- .1 Structural integrity of any element of the Work.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or other contractors.
- .6 Warranty of Products affected.

.2 Include in request:
- .1 Identification of Project.
- .2 Location and description of affected work, including drawings or sketches as required.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed work, and Products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on work of Owner or other contractors.
- .7 Written permission of affected other contractors.
- .8 Scanning or ultrasound, radar, etc. dependent on thickness of concrete slab/wall, etc.
- .9 Post tension tendon – no magnetic scan; fibre optic.
- .10 Date and time work will be executed.

1.2 PRODUCTS

.1 Unless otherwise specified, when replacing existing or previously installed Products in the course of cutting and patching work, use replacement Products of the same quality or better as those being replaced.

.2 If an existing or previously installed Product must be replaced with a different Product, submit request for substitution in accordance with Section 01250 - Substitution Procedures.

1.3 PREPARATION

.1 Inspect existing conditions in accordance with Section 01710 - Examination and Preparation.

.2 Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of the Work from damage. Design of all temporary supports to be sealed by a Professional Engineer, licenced in the province of Ontario.

.3 Provide protection from elements for areas that may be exposed by uncovering work.

1.4 EXISTING UTILITIES

.1 Assume full responsibility for protection of known under-and-above ground utilities, such as water, sewer and gas mains and house connections, hydro and telephone poles, wires and conduits, whether or not they are shown on the plans. Where depth or location of any of these utilities has been shown on the plans, such information is not guaranteed. The Contractor shall be responsible for locating all utilities. All utilities are not necessarily shown on Contract Drawings.

.2 When breaking into or connecting to existing services' utilities, execute the Work at times directed by local governing authorities, with a minimum of disturbance to the Work, pedestrian and vehicular traffic, and ongoing Owner operations. Give authority having jurisdiction and Consultant forty-eight (48) hours notice for necessary interruption of mechanical or electrical services.

.3 If Work requires a facility, system, or equipment to be isolated or shut down, submit an Isolation Request Form located in Section 01114. The Isolation Request Form is to be submitted a minimum of ten (10) working days in advance of the Work. The Work is not to proceed until the Isolation Request Form is approved by the consultant and Operating Authority.

.4 Maintain excavations free of water.

.5 Keep duration of interruptions to a minimum.

.6 Carry out interruptions after regular working hours of occupants, preferably on weekends, unless Owner's prior written approval is obtained.

.7 Protect and maintain existing active services. Record location of services, including depth, on as-built drawings.

.8 Construct or erect barriers in accordance with Section 01560 - Temporary Barriers and Enclosures as required to protect pedestrian and vehicular traffic.

1.5 CUTTING, PATCHING, AND REMEDIAL WORK

.1 Coordinate and perform the Work to ensure that cutting and patching work is kept to a minimum.

.2 Perform cutting, fitting, patching, and remedial work including excavation and fill, to make the affected parts of the Work come together properly and complete the Work.

.3 Provide openings in non-structural elements of the Work for penetrations of mechanical and electrical work.

.4 Perform cutting by methods to avoid damage to other work.

.5 Provide proper surfaces to receive patching, remedial work, and finishing.

.6 Perform cutting, patching, and remedial work using competent and qualified specialists familiar with the Products affected, in a manner that neither damages nor endangers the Work.

.7 Do not use pneumatic or impact tools without Consultant's prior approval.

.8 Ensure that cutting, patching, and remedial work does not jeopardize manufacturers' warranties.

.9 Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection. For an assembly, refinish entire unit.

.10 Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces with suitable allowance for deflection, expansion, contraction, acoustic isolation, and firestopping.

.11 Maintain fire ratings of fire rated assemblies where cutting, patching, or remedial work is performed. Completely seal voids or penetrations of assembly with firestopping material to full depth or with suitably rated devices.

END OF SECTION

1.1 BARRIERS AND ENCLOSURES - GENERAL

.1 Provide temporary barriers and enclosures necessary to protect the public and building occupants and to secure Place of the Work during performance of the Work.

.2 Separate parts of the facility required to remain in use from parts of the plant under construction.

.1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal all joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create an airtight barrier.

.2 Provide access doors equipped with latches to ensure that access is maintained for plant operation, exiting, safety, and firefighting.

.3 Comply with applicable regulatory requirements.

.4 Maintain temporary barriers and enclosures in good condition for the duration of the Work.

.5 Remove temporary barriers and enclosures from Place of the Work when no longer required.

1.2 FENCING

.1 Erect temporary security and safety site fencing of type and height determined by Contractor, subject to applicable regulatory requirements.

1.2 WEATHER ENCLOSURES

.1 Provide weather tight enclosures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.

.2 Provide weather enclosures to protect floor areas where walls are not finished and to enclose work areas that require temporary heating.

.3 Design weather enclosures to withstand wind pressure and snow loading requirements.

1.3 DUST TIGHT PARTITIONS

.1 Provide dust tight wood stud and plywood partitions to localize interior building from dust and noise generating activities. Provide sound attenuation insulation to mitigate sound transmission,

.2 Provide dust tight protection to electrical and control equipment.

.3 Temporary partitions shall be constructed using metal studs and gypsum board construction to create two (2)-hour fire separation in accordance to ULC rating in areas where the construction area must be isolated from the remainder of the floor area.

.4 Erect, maintain and relocate partitions as required to facilitate construction operations and Owners operational requirements.

1.4 FIRE ROUTES

.1 Maintain fire access routes, including overhead clearances, for use by emergency response vehicles.

1.5 PROTECTION OF BUILDING FINISHES

.1 Provide necessary temporary barriers and enclosures to protect existing and completed or partially completed finished surfaces from damage during performance of the Work.

END OF SECTION

1.1 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

.3 Debris: includes both combustible and non-combustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.

.4 Hazardous Materials: includes pesticides, biocides, and carcinogens, as listed by recognized authorities.

.5 Sediment: soil and other debris that has been eroded and transported by storm or well production runoff water.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Prior to commencing construction activities or delivery of materials to site, provide Environmental Protection Plan for review by Consultant.

.2 Ensure Environmental Protection Plan includes comprehensive overview of known or potential environmental issues to be addressed during construction.

.3 To comply with municipal, federal, and provincial policies, programs, and legislation.

.4 To comply with all requirements related to authority’s having jurisdiction.

.5 Environmental Protection Plan to include:

- .1 Name[s] of person[s] responsible for ensuring adherence to Environmental Protection Plan.
- .2 Name[s] and qualifications of person[s] responsible for manifesting hazardous waste to be removed from site.
- .3 Name[s] and qualifications of person[s] responsible for training site personnel.
- .4 Description of environmental protection personnel training program.
- .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements.
- .6 Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Ensure plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
- .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Ensure plan includes measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .9 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site. To include measures for control of interior air pollution such as volatile organic compounds.

.12 Contaminant Prevention Plan: identifying potentially hazardous substances to be used on job site and the planned storage, handling, and actions to prevent the introduction of such materials into air, water, or ground.

.13 Waste Water Management Plan: identifying methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.14 Storm Water Pollution Prevention Plan (SWPPP).

.15 Historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.16 Pesticide treatment plan.

.6 Tree Protection Plan

.1 To comply with municipal by-laws.

.2 Contractor to implement all measures identified in the tree protection plan.

1.3 FIRES

.1 Fires and burning of rubbish on-site not permitted.

1.4 EROSION AND SEDIMENT CONTROL

.1 Refer to Section 02370 Erosion and Sediment Control.

1.5 POLLUTION CONTROL

.1 Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.

.2 Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur.

.3 Promptly report spills and releases that may occur to:

.1 authority having jurisdiction,

.2 person causing or having control of pollution source, if known, and

.3 Owner and Consultant.

.4 Contact manufacturer of pollutant, if known and applicable, to obtain material safety data sheets (MSDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.

.5 Take immediate action to contain and mitigate harmful effects of the spill or release.

1.6 DEWATERING

.1 Refer to Section 02140 Dewatering.

1.7 SITE DRAINAGE

.1 Maintain grades and all existing storm sewers, ditches and culverts to be clean and free of any deleterious materials and blockages to ensure proper site drainage.

.2 Provide temporary drainage and pumping as necessary to keep excavations and project site free from water.

.3 Do not pump water containing suspended materials into waterways, sewer, or drainage systems.

.4 Prevent surface water runoff from leaving the site except as otherwise provided by site grading and the stormwater management plan.

.5 Prevent precipitation from infiltrating or from directly running off stockpiled waste materials. Cover stockpiled waste materials with an impermeable liner during periods of work stoppage including at end of each Working Day.

.6 Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas as required to prevent erosion and sedimentation.

.7 Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

1.8 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and other plant material designated to remain on site and on adjacent properties, where indicated on Drawings.

.2 Protect roots of designated trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping, and storage of materials over root zones.

.3 No site clearing may commence until:

- .1 The Environmental Plan is approved by the Consultant.
- .2 All protective measures identified in the Environmental Plan has been installed or actioned.
- .3 A pre-site clearing meeting has been held with the Subcontractor responsible for the scope of work to review the approved plans. Meeting minutes to be taken and issued to the Subcontractor, Owner, and Consultant.

.4 No tree removals may occur between April 15th and August 31st without a qualified biologist survey 72 hours prior to removals identifying if nesting birds are present. The biologist survey is to identify the species of bird and any related municipal and federal legislation that applies to the species and the actions of nest removal. No tree removals are to occur until the biologist report is submitted, reviewed, and recommended actions approved by the Consultant.

.5 Vegetation stripping and topsoil removal along forcemain alignment is to be completed in conjunction with a Nest and Acoustic Survey completed by a qualified professional. Contract shall provide the survey to the Consultant prior to stripping and removal activities.

.6 Refer to Species at Risk Screening Assessment Report in Appendix 6.

1.9 WORK ADJACENT TO WATERWAYS

.1 To comply with Ministry of the Environment, Conservation and Parks (MECP), municipal, provincial and federal by-laws, policies, and legislation including but not limited to:
- .1 Cutting of timber or timber management on Crown land.
- .2 Construction of water crossing.
- .3 Any activity on Crown land during the forest fire season.
- .4 Construction near a body of water that could have a detrimental effect on fish habitat or water quality.
- .5 Development and operation of a borrow pit or gravel pit.
- .6 Road construction.
- .7 Dam construction.

.2 Contractor shall obtain permits from the South Nation Conservation Authority and comply with all mitigation measures to protect fish habitats and water quality.

.3 All work adjacent to the South Nation River is to be conducted during seasonal low water levels to ensure no work is undertaken in water.

.4 Refer to DFO Request for Review response in Appendix 5

.5 Refer to Species at Risk Screening Assessment Report in Appendix 6

1.10 DUST AND PARTICULATE CONTROL

.1 Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.

.2 Execute Work by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.

.3 Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Use appropriate covers on trucks hauling fine, dusty, or loose materials Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.

.6 Dust control measures shall be undertaken to prevent dust nuisances resulting from any phase of the construction operation, in accordance with Section 02370.

.7 Permitted dust control measures may include the application of water.

1.11 NOISE CONTROL

.1 Noise By-laws:
- .1 All local noise by-laws must be recognized and adhered to.
- .2 Mufflers:
  - .1 All vehicles and equipment shall be equipped with efficient muffling devices to minimize noise levels in the project site area.
- .3 Noise Attenuation:
  - .1 Where necessary, noise-attenuating devices (barriers) shall be placed around stationary pumps and compressors.

1.12 HISTORICAL / ARCHAEOLOGICAL CONTROL

.1 Identify procedures to be followed if historical archaeological, cultural resources, biological resources, and wetlands not previously known to be onsite or in area are discovered during construction.

.2 Refer to Archaeological and Cultural Heritage Reports in Appendix 4

.3 The Stage 1 and 2 Archaeological assessments confirmed the potential for burial features in the vicinity of the Cemetery on J. Brisson's Farm. A Stage 3 Cemetery investigation will be undertaken within an area of approximately 327m^2 near intersection of Brisson and Principal Street.

.4 Contractor access will be restricted from any construction activity within the vicinity of the assessment area until the result and conclusions of the Archaeological Assessment are determined. A Stage 3 Protection area delineates the extent of the restricted area and is confined to the intersection of Brisson and Principal Street to Station 0+140.

.5 Contractor to schedule new forcemain alignment installation in conjunction with the Archaeological assessment timeline. Refer to Section 01810, Item 1.11.4

.6 Contractor shall provide necessary services to complete coordinate Stage 3 archaeological assessment with the Owners third party Archaeologist that include but are not limited to:
- .1 Fencing and/or barriers to restrict access to Stage 3 Archaeological Assessment area.
- .2 Vehicular and pedestrian traffic control measures for the Stage 3 Archaeological assessment.
- .3 Excavation services for the mechanical topsoil removal of the Stage 3 Archaeological Assessment area.

.7 The excavation should begin at the edge of Brisson Street and continue easterly towards the legal cemetery boundary. To avoid damage to potential features and/or human remains, an excavator with an articulated wrist and a flat-edged bucket must be utilized to remove the topsoil. The removals should be conducted incrementally to limit potential impacts to any shallow burials. Mechanical excavation must continue until the topsoil/subsoil interface is reached; this interface must then be subjected to a close examination for potential features and shovel shined or trowelled to further clarify the interface in accordance with the requirements set out in Section 4.2.3 of the 2011 S&Gs

1.13 CONTAINMENT

.1 Provide full containment equal to no less than one hundred and twenty-five percent (125%) of maximum stored volume for all hazardous substances required on-site for construction. Maintain

containment areas free of all surface water, ice, and snow.

.2 Store all hazardous materials subject to potential leakage in contained areas.

.3 Ensure that a minimum one hundred and twenty-five percent (125%) of maximum stored volume containment is always maintained for permanent or temporary treatment chemical storage.

1.14 EQUIPMENT FUELING, MAINTENANCE AND STORAGE

.1 All equipment refueling and maintenance shall be done on asphalt surfaces, or in lieu of asphalt surfaces, in areas that are fully contained (per 3.3) and above the Ministry of Natural Resources or Conservation Authority designated flood elevation, as deemed suitable by the Consultant.

.2 Contractor is to prepare a spill response plan and maintain onsite the means for the interception and rapid cleanup and disposal of spillages on land and/or water that do occur. Any spills causing impairment to the natural environment must be reported to the local MECP District Office immediately.

.3 The emptying of fuel, lubricants, and pesticides into watercourses is prohibited. All construction debris must be contained and disposed of in an approved location.

.4 Construction equipment shall be cleaned prior to entering public roadways.

.5 Construction equipment shall not be cleaned where the debris can gain access to storm sewers or watercourses.

1.15 QUALITY CONTROL

.1 Consultant will notify Contractor in writing of observed noncompliance with municipal, federal, and provincial environmental laws or regulations, permits, and other elements of Contractor's approved plans.

.2 Contractor to stop work and provide proposed corrective action to Owner, Consultant, and Authority Having Jurisdiction within twenty-four (24) hours of notice.

.3 Contractor to not implement corrective measures until receipt of written approval by Authority Having Jurisdiction.

END OF SECTION

.1 The work addressed in this specification “Traffic Control Plan” to include the preparation and submission of a Traffic Control Plan (TCP) as outlined in this specification and in Section 01571.

1.1 REFERENCES

.1 Uniform Traffic Control Devices for Ontario (UTCD), distributed by Transportation Association of Canada.

.2 Ontario Traffic Control Manual (OTM) Book 7, Temporary Conditions, Latest Edition.

1.2 DEFINITIONS

.1 Traffic Control Plan (TCP): A detailed plan for the control of traffic, including vehicular and pedestrian movements, required to allow the Contractor to fulfill all conditions of the contract, taking into account the organized, systematic safe conduct of the project. This includes, as applicable, detours, staging sequences, work, public and emergency vehicle access and egress, public access and separation from hazardous areas, temporary barriers, removal of old pavement markings, and the selection of appropriate typical layouts and devices necessary for traffic control.

1.3 SCOPE

.1 Where construction pursuant to this Contract is being carried out on or adjacent to a municipal street, the supply, placement, monitoring, and disassembly of all traffic control devices to be performed under the direction of the Contractor in accordance with the Ontario Traffic Manual latest edition.

.2 The Contractor to be responsible for construction means, methods, techniques, sequences, and procedures and for coordinating the various parts of the traffic control.

.3 The Contractor to prepare and submit a Traffic Control Plan that details the specific traffic control layout(s), necessary for the completion of the works. The Traffic Control Plan to be in the form of drawing(s) and written description(s) of how the Contractor intends to control traffic through and around the work zone. The TCP to include, and not necessarily be limited to:

.1 Monitoring and Repair (24 hour contact number if not acquired).
.2 Reference to Applicable OTM Book 7 Typical Layouts.
.3 Traffic control signs (regulatory, warning and temporary).
.4 Traffic control delineation.
.5 Traffic Control vehicles and devices (TC-12, Crash Trucks, Temporary Lighting, etc.).
.6 Contract-specific operational requirements.
.7 Nighttime requirements.
.8 Traffic staging and scheduling.
.9 Construction vehicle access/egress.
.10 Public access/egress for all existing entrances and side roads.
.11 Pedestrian safety; barriers and barricades.
.12 Emergency Vehicle access.
.13 Locations for removal of existing line painting and proposed temporary pavement markings.
.14 Parking for Consultant.
.15 Control measures to maintain one lane of access around the Stage 3 Archaeological work area.
.16 Coordination with other property owners along Brisson Street.
.17 Control measures to maintain two lanes of access around the Laurier Street work area.
.18 Coordination with other property owners along Laurier Street.

.19 Any other traffic control measures.

.4 The Contractor to refer to Section 01571 for general and contract specific requirements of traffic operations, and definition of terms.

.5 Commencement of work along Brisson Street at the Pumping Station site, the Stage 3 Archaeological Assessment area, and forcemain path along Laurier Street contingent on approval of the traffic control plan by the Municipality and Consultant. Maintain one lane of traffic around the work area at all times on Brisson Street.

1.4 SUBMISSIONS, MONITORING AND REPAIR

.1 Two (2) weeks prior to commencing construction on Municipal streets and property, the Contractor shall submit the TCP to the Consultant. The Contractor acknowledges that revisions to the TCP may be necessary, in consultation with the Town, where it concerns public safety and mobility. For signalized intersections the Plan to be submitted on a 1:250 scale. Separate plans may be submitted for the separate Casselman Main Sewage Pumping Station Upgrades construction sites.

.2 The Contractor to ensure that all workers, including sub-contractors, in the Working Area are aware of the importance of the TCP measures.

.3 The Contractor to be required to review and modify the TCP for errors, omissions, deficiencies, or because of any new hazards are identified and not previously addressed within the document.

.4 The condition of all traffic control devices to be maintained for the duration of the contract, in accordance with the OTM.

.5 The Contractor to immediately repair, replace or otherwise make good the practice deemed unsafe or non-compliant when the owner (or his delegated authority) makes the Contractor aware of any violation of the TCP (or applicable regulations). Should the Contractor disagree, the Ministry of Labour will be consulted to provide clarification of the observed deficiency.

.6 It is the responsibility of the Contractor to ensure that all necessary training has been provided prior to commencement of the work.

.7 The Municipality through the Consultant will accept the submission of the TCP, and review it to identify any errors, omissions, or improvements that the Municipal staff is aware of, as it relates to maintaining public safety and mobility.

.8 The acceptance and review of the TCP by the Municipality will make no representation and/or warranty that the document is accurate, complete, or compliant with all applicable legislation. Any errors, omissions or deficiencies within the TCP will remain the sole responsibility of the Contractor. The contract shall not commence, until the Municipality has reviewed the TCP to the satisfaction of the Consultant, and the Contractor has addressed all comments.

.9 The Consultant reserves the right to ask for revisions to the Traffic Control Plan at submission time or reject it if the plan does not meet the Contract language. In addition, the Consultant reserves the right to instruct the Contractor to revise it at any time during the Contractor's execution of the plan, when the Consultant finds that the Contractor is not providing the commitments shown in the original Traffic Control Plan submission, or the Contractor's Traffic Control Plan proves to be insufficient to address the field conditions.

END OF SECTION

PART 1 – GENERAL

1.1 DEFINITIONS

.1 Ontario Traffic Manual (OTM): All reference in this Special Provision to the Ontario Traffic Manual will indicate the most recent version(s) of the OTM including, and not necessarily be limited to, as applicable:

- .1 Book 1 - Introduction of the Ontario Traffic Manuals
- .2 Book 5 - Regulatory Signs
- .3 Book 6 - Warning Signs
- .4 Book 7 - Temporary Conditions
- .5 Book 11 - Markings and Delineations
- .6 Book 12 - Traffic Signals

.2 Traffic Control Device(s) (TCD): A generic term used to describe any person, sign, signal, marking or device placed upon, over or adjacent to a roadway by or at the direction of a public authority or official having jurisdiction (such as the Municipality of Casselman) or their designate, for the purpose of regulating, warning, guiding or informing a vehicle operator or pedestrian of an existing condition or hazard.

.3 Traffic Control Plan (TCP): A detailed plan for the control of traffic, including vehicular and pedestrian movements, required to allow the Contractor to fulfill all conditions of the contract, taking into account the organized, systematic safe conduct of the project. This includes, as applicable, detours, staging sequences, work, public and emergency vehicle access and egress, public access and separation from hazardous areas, temporary barriers, removal of old pavement markings, and the selection of appropriate typical layouts and devices necessary for traffic control.

.4 Traffic Control Persons (TCP's): A person duly trained and authorized to direct traffic at a work zone through the use of the Traffic Control Sign (STOP/SLOW Paddle)

.5 Traffic Protection Plan (TPP): A plan required by the Occupational Health and Safety Act and its regulations for the protection of workers in a work zone. The plan must contain a written description of the traffic hazards to which workers may be exposed and measures used to protect them.

.6 Traffic Management Plan (TMP): A requirement of the road cut permit. TMP means a standard outlining the particulars of proposed work on any highway described on Schedule "B" that is submitted by or on behalf of the Contractor to the Municipality for approval. The Traffic Management Plan to contain the information respecting how the applicant intends to comply with this by-law including but not limited to the following:

- .1 Start and completion times of work;
- .2 Specific location of work;
- .3 Requirement to work during peak hours, if any;
- .4 Lane use requirements;
- .5 Requirements for road closure;
- .6 Public notification undertaken;
- .7 Parking meters affected by work;
- .8 Requirement for temporary no stopping signs;
- .9 Identification of any bus route(s) and bus stops affected by work activity; and
- .10 Traffic routing and detour requirements where required.

1.2 GENERAL REQUIREMENTS

.1 The Ontario Traffic Manual supersedes all reference in this contract document to the Ministry of Transportation, Manual for Uniform Traffic Control Devices, or MUTCD.

.2 Prior to commencing any construction, on or adjacent to a municipal street, the supply and placement of all necessary temporary traffic control devices to be performed under the sole direction of the Contractor and in accordance with the Contractors submitted/reviewed Traffic Control Plan. The Traffic Control Plan (herein the TCP) to be developed in accordance with guidelines established by the most recent version of the Ontario Traffic Manual, (herein the OTM) the Occupational Health and Safety Act (herein the OHSA), and Section 01570 – Traffic Control Plan which details the required contents and submission of the TCP.

.3 Vehicular and pedestrian traffic control to remain the sole responsibility of the Contractor as the Municipality delegates this authority to the Contractor in accordance with the submitted/reviewed TCP. Notwithstanding the foregoing, the Contractor to, at his own expense, remove any equipment or material, which in the Consultants opinion, constitute a hazard to traffic or pedestrians.

.4 The Contractor to be fully and solely responsible to ensure the development and implementation of a submitted/reviewed traffic control plan as required in Section 01570 – Traffic Control Plan. The TCP and all required traffic control devices to be designed/installed, monitored, operated/maintained and removed by the Contractor, utilizing only competent persons and workers as defined under the OHSA.

.5 The Contractor to not store any equipment or materials on the road or the roadway shoulders or boulevards, unless the storage areas are identified in the TCP and appropriate traffic control devices protect the equipment or materials. The Consultant to review and approve any storage of equipment and/or materials within the ROW.

.6 The Contractor to remove all dirt and debris from all paved or concrete surfaces at the close of each workday, to the satisfaction of the Consultant.

.7 The Contractor to designate a person to be responsible for traffic control and work zone safety. The designated person to be a competent worker who is qualified because of knowledge, training, and experience to perform the duties; is familiar with Book 7 of the Ontario Traffic Manual; and has knowledge of all potential or actual danger to workers and motorists. Prior to the commencement of construction, the Contractor to notify the Consultant of the name; address; position and telephone numbers of the designated person, and update as necessary. The designated person may have other responsibilities, including other construction sites, and need not be present in the Working Area at all times.

1.3 TRAFFIC CONTROL DELINEATION AND OPERATION

.1 Prior to commencing any construction pursuant to this Contract, the Contractor to supply and place all necessary temporary traffic control devices.

1.4 VEHICULAR ACCESS TO ENTRANCES AND SIDE ROAD

.1 The Contractor to maintain through, or around, the working area a satisfactory condition for traffic, to provide vehicle access for all existing entrances and side roads, and ensure that all entrances and side streets are maintained and are operational, all to the satisfaction of the Consultant. All vehicle access to existing entrances and side roads must be provided once the construction for the day is

completed, unless the owner of the property has provided consent to allow the access to remain closed. All the costs associated with this work to be borne by the Contractor.

.2 All temporary loss of access/egress necessary to complete the works must include 24 hr prior notification to the business or resident(s). Such notification regarding the loss of access/egress is the sole responsibility of the Contractor.

1.5 SITE PEDESTRIAN CONTROL

.1 The Site Pedestrian control includes all temporary pedestrian signing; directional signing; maintenance of sidewalk; relocation and any other delineation to provide safe environment for pedestrians.

1.6 PEDESTRIAN ACCESS

.1 Unless otherwise specified in the contract, a free and unobstructed hard surfaced pedestrian walkway acceptable for use by physically challenged individuals, including pedestrian access to all buildings, must be provided, clearly identified, and maintained in a good state of repair, to the satisfaction of the Consultant, through or around the construction site at all times.

1.7 PARKING

.1 The Traffic and Parking By-law allows for on-street parking at locations throughout the contract limits, except where stated otherwise for residents.

.2 The Contractor's employees must be advised that parking regulations on Municipal streets in the vicinity of the construction zone will be enforced and will be subject to the Municipality's Parking By-Law. If the Contractor wishes its employees to park on adjacent Municipality roads, in contravention of the Traffic and Parking By-law, an application must be made to the Municipality for an encroachment permit.

.3 A designated safe parking area to be specified in Traffic Control Plan for the Consultant for the duration of the contract. This parking area to accommodate a minimum of two (2) vehicles and reserved for Municipal contract administration staff.

.4 The Contractor to make no claim for the additional costs of obtaining an encroachment permit or for any parking tickets issued to its employees.

1.8 TEMPORARY LINE PAINTING

.1 The Contractor is responsible for all temporary line painting and removals unless otherwise stated in the Contract. All temporary line painting treatments should be specified and detailed in the Traffic Control Plan.

.2 Removal of temporary line painting to be by means of asphalt grinding, sandblasting or some other form of mechanical removal and not by the use of black paint unless otherwise stated.

.3 Between November 15 and April 15, the Contractor will be responsible for spotting and placing permanent, or final, line painting.

.4 The Contractor will be required to rectify any errors or inconsistencies in its permanent or final line painting to the satisfaction of the Consultant.

.5 This requirement will not be considered for separate payment unless the applicable items are included in the schedule of prices. The inclusion of this item is at the sole discretion of the Owner.

.6 The Contractor shall not make any claim for extra compensation or delays to the project for the impact this provision may have on the construction of the roadway and related works.

1.9 CONTRACT SPECIFIC REQUIREMENTS

.1 Disruption to traffic and pedestrian movement to be minimized during project. In determining the expected traffic and pedestrian operations for the project, the Contractor is advised of the following requirements that shall apply to this Contract:

- .1 Brisson Street and Laurier Street – Single and two lane traffic movement directed by traffic control personnel and or traffic control devices to be maintained for all work.
- .2 Ste-Euphémie Elementary School – Uninterrupted Access
- .3 Work area is to be made safe and passable for two-way traffic and pedestrians at the end of each workday. Traffic control measures are to be removed outside of working hours unless indicated otherwise in the TCP.

1.10 LANE CLOSURES

.1 Where construction pursuant to this Contract will require temporary lane closures, the lane closures to be carried out by the Contractor at the Contractor's expense. The Contractor to give forty-eight (48) hours notice to the Consultant prior to the day on which the lane closures will be required.

1.11 SIGNAGE

.1 Contractor to be responsible during construction to remove, install or modify any necessary regulatory signage due to the requirements of the traffic control plan. The Contractor to notify the Consultant 10 Calendar days prior to this requirement. Temporary regulatory signage to be provided and installed by the Contractor, as necessary.

.2 Contractor to be responsible to install and remove all necessary signage for any proposed detour routes. The contractor to notify the Municipality a minimum 10 Calendar days in advance of the requirement for the detour.

.3 Any road closures are the responsibility of the Contractor and any associated temporary signage, temporary line painting, and traffic control devices are the responsibility of the Contractor (including those required outside of the construction zones e.g., TC-54 flexible drums and signs required to take out of service auxiliary lanes.) Any changes to and new regulatory signage required for the closures are the responsibility of the Contractor, with the exception of the supply and installation of RB-90A, RB-90B, RB-25, and Wa-33L type signs required for any temporary road closures or detours.

END OF SECTION

1.1 GENERAL

.1 Provide Products that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by Consultant, furnish evidence as to type, source and quality of Products provided.

.2 Unless otherwise specified, maintain uniformity of manufacture for like items throughout.

.3 Permanent manufacturer's markings, labels, trademarks, and nameplates on Products are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.

1.2 PRODUCT AVAILABILITY AND DELIVERY TIMES

.1 Promptly upon Contract award and periodically during construction, review and confirm Product availability and delivery times. Order Products in sufficient time to meet the construction progress schedule and the Contract Time.

.2 If a specified Product is no longer available, promptly notify Consultant. Consultant will act as required.

.3 If delivery delays are foreseeable, for any reason, promptly notify Consultant.

.1 If a delivery delay is beyond Contractor's control, Consultant will provide direction.

.2 If a delivery delay is caused by something that was, or is, within Contractor's control, Contractor shall propose actions to maintain the construction progress schedule for Consultant's review and acceptance.

1.3 PRODUCT OPTIONS

.1 Subject to the provisions of Section 01250 –Substitution Procedures:

.1 Wherever a Product or manufacturer is specified by a single proprietary name, provide the named Product only.

.2 Wherever more than one Product or manufacturer is specified by proprietary name for a single application, provide any one of the named Products.

.3 Wherever a Product is specified by reference to a standard only, provide any Product that meets or exceeds the specified standard. If requested by Consultant, submit information verifying that the proposed Product meets or exceeds the specified standard.

.4 Wherever a Product is specified by descriptive or performance requirements only, provide any Product that meets or exceeds the specified requirements. If requested by Consultant, submit information verifying that the proposed Product meets or exceeds the specified.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Store, handle and protect products during transportation to Place of Work and before, during, and after installation in a manner to prevent damage, adulteration, deterioration, and soiling.

.2 Comply with manufacturer's instructions for storage, handling, and protection.

.3 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.

.4 Store products subject to damage from weather in weatherproof enclosures.

.5 Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of material safety data sheets (MSDS).

.6 Store sheet products on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Remove and replace damaged products.

.8 Touch-up damaged factory finished surfaces to Consultant’s] satisfaction. Use touch-up materials to match original. Do not paint over name plates.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION OF SECTION

.1 This section provides an overview and summary of site-wide vibration isolation and seismic control measures to be undertaken for the Work.

1.2 GENERAL SCOPE

.1 All mechanical and electrical equipment, piping and ductwork (non-structural components) as noted on the equipment schedules or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.

.2 All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer and shall be certified by the manufacturer. Shop drawings and certification sheets shall be supplied by the Contractor.

.3 It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place and operational during/following a seismic event. The facility will be considered a “post-disaster” facility per Ontario Building Code (OBC) 2012.

.4 All such systems must be installed in strict accordance with seismic codes, component manufacturer’s building construction standards. Whenever a conflict occurs between the manufacturer’s recommendations or construction standards, the most stringent shall apply.

.5 The Contractor shall correct any variance or non-compliance with these specification requirements in an approved manner at no additional cost to the Owner.

.6 Seismic restraints shall be designed by the Contractor or their specialty subcontractor in accordance with seismic requirements stipulated in Part 4 of the OBC 2012.

.7 The work in this section includes, but is not limited to the following:

- .1 Design of the seismic restraint systems by the Contractor.
- .2 Vibration isolation for piping, ductwork and equipment.
- .3 Equipment isolation bases.
- .4 Flexible piping connections.
- .5 Seismic restraints for isolated equipment.
- .6 Seismic restraints for non-isolated equipment.
- .7 Certification of seismic restraint designs and installation supervision.
- .8 Certification of seismic attachment of equipment pads.
- .9 All mechanical and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical.
- .10 All other Operational and Functional Components (OFCs) including, but not limited to, lighting, mechanical units, etc.

1.3 DEFINITIONS

.1 Life Safety Systems:

.1 All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
.2 All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flow paths to fire protection and/or emergency lighting systems.
.3 All medical and life support systems.
.4 Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

.2 Positive Attachment:
.1 A positive attachment is defined as a cast-in anchor, a post-installed seismic qualified anchor, a double-sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided “C” type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic anchor points.

.3 Transverse Bracing:
.1 Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.

.4 Longitudinal Bracing:
.1 Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

.5 Operational and Functional Components (OFCs) are non-structural building components including architectural finishes, building service components (mechanical, electrical, telecommunication) and building contents.

1.4 SUBMITTALS

.1 Shop Drawings:
.1 Submit shop drawings in accordance with Division 1.
.2 Submit isolation and restraints for each piece of equipment.
.3 Submit product data sheets for isolation components.
.4 Show fabrication details, location and size of anchor bolts and requirements for inertia / steel bases.
.5 Submit fabrication details for equipment basis including dimensions, structural member sizes and support point locations.
.6 Provide all details of suspension and support for ceiling hung equipment.
.7 Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers’ submittals must include spacing, static loads and seismic loads at all attachment and support points.
.8 Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
.9 Shop drawings are to be sealed by a Professional Engineer registered in the Province of Ontario for all designed assemblies, components and connections.

.2 Seismic Certification and Analysis:
.1 Seismic restraint calculations are to be provided by the Contractor for all connections of equipment to the structure. Calculations are to be stamped by a registered Professional Engineer licensed in the Province of Ontario.

.2 All restraining devices shall have a pre-approval number from a recognized government agency showing maximum restraint ratings. Pre-approvals based on independent testing are preferred to pre-approvals based on calculations. Where pre-approved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the province of the job location.

.3 Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces calculated in accordance with the OBC 2012 acting through the equipment centre of gravity. Overturning moments may exceed forces at ground level.

.3 The Contractor is to provide a letter sealed by the Consultant responsible for preparing the shop drawings confirming that equipment, piping and ducting is installed in conformance with the design for support and seismic restraint.

1.5 QUALIFICATIONS

.1 Design and inspection of seismic restraint to be carried out by a qualified Professional Engineered licensed in the province of Ontario with a minimum of 5 years' experience in the design of lateral restraint for specific discipline of OFCs.

1.6 MANUFACTURER'S RESPONSIBILITY

.1 Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:

.1 Determine vibration isolation and seismic restraint sizes and locations.

.2 Provide vibration isolation and seismic restraints as schedule or specified.

.3 Provide calculations and materials if required for restraint of un-isolated equipment.

.4 Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

1.7 RELATED WORK

.1 Equipment Pads:

.1 Equipment pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.

.2 Equipment pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of twelve (12) bolt diameters all around the outermost anchor bolt to allow development of full drill-in anchor ratings.

.2 Supplementary Support Steel:

.1 Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc., including roof-mounted equipment, as required or specified.

.3 Attachments:

.1 Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double-sided beam clamps, etc., in accordance with the requirements of the vibration vendor's calculations.

1.8 SEISMIC DESIGN PARAMETERS

.1 Refer to section 01331.

1.9 QUALITY ASSURANCE

.1 Vibration control measures to conform to the latest edition of the ASHRAE standards for vibration control and isolation.

.2 Seismic control measures to conform to the latest edition of the following standards:
- .1 Ontario Building Code (OBC).
- .2 ASHRAE and SMACNA Standards for Seismic Restraint.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

.1 Mason Industries Inc. or approved alternate. Products of other manufacturers are acceptable provided their systems strictly comply with the specification and have the approval of the specifying Consultant.

PART 3 - EXECUTION

3.1 GENERAL

.1 All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturer’s written instructions and all certified submittal data.

.2 Coordinate work with other trades to avoid rigid contact with the building.

.3 Correct, at no additional cost to the Owner, all installations that are deemed defective in workmanship and materials at the Contractor’s expense.

.4 Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, piping or conduit.

.5 Cable restraints are installed taut on non-isolated systems. Seismic solid braces may be used in place of cables on rigidly attached systems only.

.6 At locations where seismic restraints are located, the support rods must be braced when necessary to accept compressive loads with Hanger Seismic Restrain Clamps.

.7 At all locations where seismic restraints are attached to pipe clevises, the clevis cross bolt must be reinforced with Clevis Seismic Braces.

.8 Vibration isolation manufacturer shall furnish integral structural steel bases or reinforced concrete inertia bases as required. Independent steel rails are not permitted on this project.

.9 Use In-Line Pump Securement Brackets for in-line pump installation.

.10 Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight by Horizontal thrust restraints.

.11 Locate isolation hangers as near to overhead support structure as possible.

.12 Inspect complete installation on system start-up and report in writing to Consultant changes necessary to prevent short circuiting transmission. Perform changes necessary to eliminate short circuiting or to increase vibration isolation efficiency.

END OF SECTION

1.1 SURVEYOR QUALIFICATIONS

.1 Engage a registered land surveyor, licensed to practice in Place of the Work.

1.2 SUBMITTALS

.1 Submit name and address of registered land surveyor performing survey work.

.2 Submit documentation to verify accuracy of field engineering work upon request of Consultant.

.3 Submit to Consultant the survey of the Work prepared and issued by a registered land surveyor as required by authorities having jurisdiction and on completion of the Work.

1.3 SURVEY REFERENCE POINTS

.1 Locate and confirm permanent reference points prior to starting site work. Preserve and protect permanent reference points on site during construction.

.2 Do not change or relocate reference points without prior written notice to Consultant.

.3 Report to Consultant when a reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

.4 Require registered land surveyor to replace reference points in accordance with original survey.

1.4 SURVEY REQUIREMENTS

.1 Establish sufficient permanent benchmarks on site, referenced to established benchmarks by survey control points.

.2 Confirm that existing survey reference points are in accordance with Owner’s survey and property limits.

.3 Establish initial lines and levels for building layout.

.4 Maintain a complete, accurate log of control and survey work as it progresses. Record locations with horizontal and vertical data in project record documents.

1.5 EXISTING UTILITIES AND STRUCTURES

.1 Before commencing excavation, drilling, or other earthwork, establish or confirm location and extent of all existing underground utilities and structures in work area.

.2 Promptly notify Consultant if underground utilities, structures, or their locations differ from those indicated in Contract Documents or in available project information. Consultant will provide appropriate direction.

.3 Where the Work involves breaking into or connecting to existing services or utilities, carry out the Work at times directed by governing authorities, with minimum of disturbance to pedestrian and vehicular traffic.

.4 Submit schedule to and obtain approval from the Consultant for any shut-down or closure of active service. Adhere to approved schedule and provide notice to affected parties. Allow for forty-eight (48) hours. to receive Owner approval for shut down or closure of active service.

.5 Be responsible to implement temporary measures to maintain normal facility operations if a utility or service is damaged by construction. Coordinate and be responsible for costs to repair damaged service.

.6 Record locations of maintained, re-routed and abandoned utility lines.

.7 Remove abandoned service lines within two (2 m) of structures. Cap or otherwise seal lines at cut-off points as directed by Consultant.

1.6 VERIFICATION OF EXISTING CONDITIONS

.1 Where work specified in any Section is dependent on the work of another Section or Sections having been properly completed, verify that work is complete and, in a condition, suitable to receive the subsequent work. Commencement of work of a Section that is dependent on the work of another Section or Sections having been properly completed, means acceptance of the existing conditions.

.2 Verify that ambient conditions are suitable before commencing the work of any Section and will remain suitable for as long as required for proper setting, curing, or drying of Products used.

.3 Ensure that substrate surfaces are clean, dimensionally stable, cured, and free of contaminants.

.4 Notify Consultant in writing of unacceptable conditions.

END OF SECTION

1.1 SUMMARY

.1 Except where otherwise specified in technical Specifications or otherwise indicated on Drawings, comply with requirements of this Section.

1.2 MANUFACTURER'S INSTRUCTIONS

.1 Install, erect, or apply Products in strict accordance with manufacturer's instructions.

.2 Notify Consultant, in writing, of conflicts between Contract Documents and manufacturer's instructions where, in Contractor's opinion, conformance with Contract Documents instead of the manufacturer's instructions may be detrimental to the Work or may jeopardize the manufacturer's warranty.

.3 Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.4 Provide manufacturer's representatives with access to the Work at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities.

1.3 CONCEALMENT

.1 Conceal pipes, ducts, and wiring in floors, walls and ceilings in finished areas:
- .1 after testing;
- .2 after Contractor quality control and quality assurance inspection;
- .3 after review by Consultant and authority having jurisdiction, and;
- .4 where locations differ from those shown on Drawings, after recording actual locations on as-built drawing.

.2 Provide incidental furring or other enclosures as required.

.3 Notify Consultant in writing of interferences before installation.

1.4 FASTENINGS – GENERAL

.1 Refer to Technical Sections for fastening requirements. Contractor to adhere to more stringent requirements.

.2 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials.

.3 Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.

.4 Use non-corrosive fasteners and anchors for securing exterior work and in spaces where high humidity levels are anticipated.

.5 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage.

.6 Keep exposed fastenings to a minimum, space evenly and install neatly.

.7 Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.

1.5 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Bolts shall not project more than one diameter beyond nuts.

1.6 FIRE RATED ASSEMBLIES

.1 When penetrating fire rated walls, ceiling, or floor assemblies, completely seal voids with fire-stopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

1.7 LOCATION OF FIXTURES OUTLETS AND DEVICES

.1 Consider location of fixtures, outlets, and devices indicated on Drawings as approximate.

.2 Locate fixtures, outlets, and devices to provide minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements.

.3 Promptly notify Consultant in writing of conflicting installation requirements for fixtures, outlets, and devices. If requested, indicate proposed locations and obtain approval for actual locations.

1.8 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS

.1 Adequately protect parts of the Work completed and in progress from any kind of damage.

.2 Promptly remove, replace, clean, or repair, as directed by Consultant, work damaged as a result of inadequate protection.

.3 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the safety or integrity of the Work.

1.9 REMEDIAL WORK

.1 Notify Consultant of, and perform remedial work required to, repair or replace defective or

unacceptable work. Ensure that properly qualified workers perform remedial work. Coordinate adjacent affected work as required.

END OF SECTION

1.1 REGULATORY REQUIREMENTS

.1 Comply with applicable regulatory requirements when disposing of waste materials.

.2 Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

1.2 GENERAL CLEANING REQUIREMENTS

.1 Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.

.2 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.3 Prevent cross-contamination during the cleaning process.

.4 Notify the Consultant of the need for cleaning caused by Owner or other contractors.

1.3 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

.1 Maintain Work in a tidy and safe condition, free from accumulation of waste materials and construction debris.

.2 Provide appropriate, clearly marked, containers for collection of waste materials and recyclables.

.3 Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each Working Day. Collect packaging materials for recycling or reuse.

.4 Remove waste materials and recyclables from Place of the Work at regular intervals or dispose of as directed by the Consultant. Do not burn waste materials on-site, unless approved by the Consultant.

.5 Clean interior building areas prior to start of finish work and maintain free of dust and other contaminants during finishing operations.

.6 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.

.7 Obtain permits from authorities having jurisdiction for disposal of waste and debris.

.8 Dispose of waste materials and debris off-site, in accordance with authorities having jurisdiction.

.9 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.10 Clear snow and ice from public sidewalks as required to comply with applicable municipal regulatory requirements.

.11 Clear snow and ice as required to facilitate the Work. This shall include snow removal, sanding, and de-icing activities. Transport snow from site to designated areas as per the requirements of local

authorities having jurisdiction as needed.

1.4 FINAL CLEANING

.1 Before final cleaning, arrange a meeting at Place of the Work to determine the acceptable standard of cleaning. Ensure that Owner, Consultant, Contractor and cleaning company are in attendance.

.2 Remove from Place of the Work surplus Products, waste materials, recyclables, Temporary Work, and Construction Equipment not required to perform any remaining work.

.3 Provide professional cleaning by a qualified, established cleaning company.

.4 Lock or otherwise restrict access to each room or area after completing final cleaning in that area.

.5 Re-clean as necessary areas that have been accessed by Contractor's workers prior to Owner occupancy.

.6 Remove stains, spots, marks, and dirt from finished surfaces, electrical and mechanical fixtures, furniture fitments, walls, floors.

.7 Wax, seal, shampoo or prepare floor finishes as recommended by manufacturer.

.8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and all other finished surfaces, including mechanical and electrical fixtures. Replace broken, scratched or otherwise damaged glass.

.9 Remove dust from lighting reflectors, lenses, lamps, bulbs, and other lighting surfaces.

.10 Vacuum clean and dust exposed wall, floor, and ceiling surfaces, behind grilles, louvres and screens,.

.11 Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment if equipment is used during construction.

.12 Remove waste material and debris from crawlspaces and other accessible concealed spaces.

.13 Remove stains, spots, marks, and dirt from exterior facades.

.14 Clean exterior and interior window glass and frames.

.15 Clean and sweep roofs, clear roof drains, clean gutters and downspouts, and sunken wells.

.16 Sweep clean sidewalks, steps, driveways, roads, parking lots, and other paved surfaces. Remove snow and ice from accesses to buildings.

.17 Use leaf blowers to clean landscaped surfaces.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements. Refer to Section 01065 Designated Substances Report for responsibilities and disposal of designated substances.

.2 Do not burn or bury waste materials at Place of the Work.

.3 Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from Place of the Work, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.

.4 Cover or wet down dry waste materials to prevent blowing dust and debris.

END OF SECTION

1.1 INSPECTION AND REVIEW BEFORE READY-FOR-TAKEOVER

.1 Contractor's Inspection: Before applying for the Consultant's review to establish Ready-for-Takeover of the Work:
- .1 Ensure that the specified prerequisites to Ready-for-Takeover of the Work are completed.
- .2 Conduct an inspection of the Work to identify defective, deficient, or incomplete work.
- .3 Prepare a comprehensive and detailed list of items to be completed or corrected.
- .4 Provide an anticipated schedule and costs for items to be completed or corrected.

.2 Consultant's Review: Upon receipt of the Contractor's application for review, together with the Contractor's list of items to be completed or corrected, the Consultant will review the Work. The Consultant will advise the Contractor whether or not the Work is Ready-for-Takeover and will provide the Contractor with a list of items, if any, to be added to the Contractor's list of items to be completed or corrected. Provide the Consultant with a copy of the Contractor's revised list.

.3 Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. The Contractor's inspection and Consultant's review procedures specified above shall be repeated until the Work is Ready-for-Takeover and no items remain on the Contractor's list of items to be completed or corrected.

.4 Submit written certificates in English that tasks have been performed as follows:
- .1 Fire alarm verification certificate issued to Consultant.
- .2 Final Electrical Safety Authority (ESA) Inspection Certificate for entire Project issued to Consultant.
- .3 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies.
- .4 Final Commissioning report and balancing report for all Mechanical / Electrical items.

.5 When the Consultant determines that the Work is Ready-for-Takeover, the Consultant will notify the Contractor and the Owner in writing to that effect.

1.2 PREREQUISITES TO FINAL PAYMENT

.1 After Ready-for-Takeover of the Work and before submitting an application for final payment in accordance with the General Conditions of the Contract:
- .1 Correct or complete all remaining defective, deficient, and incomplete work.
- .2 Remove from the Place of the Work all remaining surplus Products, Construction Equipment, and Temporary Work.
- .3 Perform final cleaning and waste removal necessitated by the Contractor's work performed after Ready-for-Takeover, as specified in Section 01740 – Cleaning.

1.3 SUBSTANTIAL PERFORMANCE OF THE WORK

.1 The prerequisites to, and the procedures for, attaining Substantial Performance of the Work, or similar such milestone as provided for in the lien legislation applicable to the Place of the Work, shall be:
- .1 Independent of those for attaining Ready-for-Takeover of the Work, and
- .2 In accordance with the lien legislation applicable to the Place of the Work.

1.4 FINAL COMPLETION

.1 When the Consultant determines that the Work has been completed, the Contractor is to apply for final payment.

.2 If the application for final payment requires holdback for finishing work to be retained, submit application for release of finishing holdback.

END OF SECTION

1.1 OPERATION AND MAINTENANCE MANUAL

.1 Prepare a comprehensive operation and maintenance manual, in the language[s] of the Contract, using personnel qualified and experienced for this task.

.2 Submit an initial digital draft of the operation and maintenance manual six (6) weeks prior to application for Substantial Performance or twelve (12) weeks prior to placing equipment into operation, which ever occurs first, for Consultant's review. If required by Consultant's review comments, revise manual contents and resubmit for Consultant's review. If required, repeat this process until Consultant accepts the draft manual in writing.

.3 Consultant acceptance and Owner receipt of the final version of the operation and maintenance manual is a requirement to apply for Substantial Performance.

.4 Submit final version to Owner in hard copy and electronic format. Provide 3 (three) hard copies. Provide two (2) electronic copies on USB drives or provide an electronic version via alternative electronic file transfer method acceptable to Owner.

1.2 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 75mm, three D-rings, loose leaf, 216 x 279 mm, with spine and face pockets. Binder content to be filled to 2/3 of the binder.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine. Provide separate binders for Division 15, 16, and 17.

.4 Cover: Identify each binder with typed title "Operation and Maintenance Manual", name of Project or Facility, name of Owner, contract name and number, and subject matter of contents. Handwritten or laser originals are unacceptable. Owner and Facility name to be in all caps. Facility name to have the largest and boldest print.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide mylar tabbed fly leaf for each separate Product or system, with typed description of Product and major component parts of equipment.

.7 Text: Manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

.9 Provide electronic copy of manual in PDF format on electronic media acceptable to Owner.

.10 Provide electronic copy of Shop Drawings in manual as 1:1 scaled CAD files in .dwg format on USB drive or via electronic file transfer method acceptable to Owner.

1.3 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT

.1 Table of contents for each volume.

.2 Introductory information including:
- .1 Date of manual submission.
- .2 Complete contact information for Consultant, subconsultants, other consultants, and Contractor, with names of responsible parties.
- .3 Schedule of Products and systems indexed to content of volume.

.3 For each Product or system, include complete contact information for Subcontractors, Suppliers and manufacturers, including local sources for supplies and replacement parts.

.4 Product Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.

.5 Reviewed Shop Drawings.

.6 Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.

.7 Warranties.

.8 Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.

.9 Training materials as specified in Section 01790 - Demonstration and Training.

1.4 OPERATION AND MAINTENANCE MANUAL - EQUIPMENT AND SYSTEMS CONTENT

.1 Each Item of Equipment and Each System: include description of unit or system and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance and/or engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include testing and balancing reports.

.15 Include additional content as specified in technical Specifications sections.

1.5 OPERATION AND MAINTENANCE MANUAL - PRODUCTS AND FINISHES CONTENT

.1 Include Product data, with catalogue number, options selected, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured Products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

.4 Include additional content as specified in technical Specifications sections.

1.6 OPERATION AND MAINTENANCE MANUAL - WARRANTIES CONTENT

.1 Separate each warranty with index tab sheets keyed to Table of Contents listing.

.2 List each warrantor with complete contact information.

.3 Warranties are to be executed by warrantor. Co-execute submittals where applicable.

.4 Provide two (2) copies of each warranty.

.5 Verify that documents are in proper form and contain full information. Ensure that warranties are for the correct duration and are in Owner’s name.

1.7 WARRANTY MANAGEMENT PLAN

.1 Develop and submit warranty management plan for Consultant approval.

.2 Warranty management plan information to include:

.1 The role and responsibilities of personnel associated with warranty process including contact information.

.2 A communication procedure for the Owner to notify the Contractor of construction warranty defects and assign a priority level for corrective action.

.3 A monitoring and reporting process to log, schedule corrective action, and obtain acceptance of correction from Owner for each warranty item.

.4 A procedure and status of tagging of equipment covered by extended warranties.

.5 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Organization, name and phone numbers of manufacturers or suppliers.

.5 Organization, names and phone numbers of persons to call for extended warranty service.

.6 Names, addresses and telephone numbers of sources of spare parts.

.7 Warranties and terms of warranty: include one (1) year warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.8 Status of receipt of warranty submission.

.9 Warranty certificate number as applicable.

.10 Start date and duration of warranty period.

.11 Summary of maintenance procedures required to maintain warranty. Identify if copies of maintenance instructions are posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.12 Cross-reference to specific pertinent Operation and Maintenance manuals.

.3 Thirty (30) days prior to expiry of the standard warranty period, Contractor is to schedule a joint warranty inspection to include the Owner and their representatives and the Consultant.

.4 Contractor to promptly coordinate with Owner, schedule, and correct all warranty items noted in warranty inspection.

1.8 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Consultant.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Do not fill out date of acceptance until project achieves occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Contractor name.

1.9 COMMISSIONING MANUAL

.1 Prepare a separate comprehensive commissioning manual, in the language[s] of the Contract, using personnel qualified and experienced for this task documenting start-up reports, testing and

commissioning activities, and performance testing.

.2 Submit draft format of the commissioning manual for Consultant's review. If required by Consultant's review comments, revise manual contents and resubmit for Consultant's review. If required, repeat this process until Consultant accepts the draft manual in writing.

.3 Submit the final commissioning manual two (2) weeks prior to application for Substantial Performance for Consultant's review. If required by Consultant's review comments, revise manual contents and resubmit for Consultant's review. If required, repeat this process until Consultant accepts the draft manual in writing.

.4 Format binders in a manner similar to the Operation and Maintenance Manual format.

.5 Commissioning Manual to include all paperwork related to equipment start up, equipment and material testing, commissioning documents, performance testing, and operator training records.

.6 Consultant acceptance and Owner receipt of the final version of the commissioning manual is a requirement to apply for Substantial Performance.

.7 Submit final version to Owner in hard copy and electronic format. Provide 4 (four) hard copies. Provide two (2) electronic copies on USB drives or via alternative electronic file transfer methods acceptable to Owner.

1.10 CONTRACTOR'S AS-BUILT DRAWINGS

.1 Submit final as-built drawings in the form specified in Section 01320 – Construction Progress Documentation to Consultant.

1.11 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01710 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.12 PROGRESS PHOTOGRAPHS

.1 Consolidate and submit progress photographs on USB drive(s) or via alternative electronic file transfer methods acceptable to Owner.

.2 Progress photographs to be organized by folder and date of submission.

1.13 SPARE PARTS, MAINTENANCE MATERIALS, AND SPECIAL TOOLS

.1 Supply spare parts, maintenance materials, and special tools in quantities specified in technical Specifications sections.

.2 Ensure spare parts and maintenance materials are new, not damaged nor defective, and of same

quality, manufacturer, and batch or production run as installed Products.

.3 Provide tags for spare parts and special tools identifying their function and associated Product.

.4 Deliver to and store items to 16 Brisson Street or any other alternate location within 25 km of project site as directed by Owner. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.

.5 Deliver to and store items to 224 Laurier Street or any other alternate location within 25 km of project site as directed by Owner. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.

.6 Catalogue all items and submit to Consultant an inventory listing organized by Specifications section. Include Consultant reviewed inventory listing in operation and maintenance manual.

END OF SECTION

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate and provide training to Owner's personnel on operation and maintenance of equipment, building envelope, and systems two (2) weeks prior to scheduled date of Performance Trial Operation].

.2 Owner will provide list of personnel to receive training and will coordinate their attendance at agreed upon times.

.3 Coordinate and schedule demonstration and training provided by Subcontractors and Suppliers.

.4 Attendance sheet to be provided by Contractor for training session. All Owner personnel to sign attendance sheet. Provide copy to Owner.

1.2 PREREQUISITES TO DEMONSTRATION AND TRAINING

.1 Testing, adjusting, and balancing has been performed in accordance with Contract Documents.

.2 Equipment and systems are fully operational.

.3 Copy of completed operation and maintenance manual is available for use in demonstration and training.

.4 Conditions for demonstration and training comply with requirements specified in technical Specifications.

1.3 SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system thirty (30) Working Days prior to designated dates, for Owner approval. Training schedule to allow for and accommodate Owner's staff availability.

.2 Provide training plan for each Manufacturer training session containing the following minimum information:

- .1 Title and objectives.
- .2 Recommended attendees (eg. Managers, Engineers, Operators, Facility Maintenance, etc.)
- .3 Course description and syllabus.
- .4 Training materials and equipment requirements.
- .5 Resumes of Manufacturer representatives providing the training.

.3 Provide three (3) copies of completed operation and maintenance manuals and training materials for use in demonstrations and instructions.

.4 Provide attendance sheet identifying the time and date of each demonstration and list of persons present.

.5 Provide training certificates after each training session for each attendee.

.6 Submit a Training Manual including training materials, reports, and operator training certificates within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.7 Provide electronic copy of video training sessions.

1.4 DEMONSTRATION AND TRAINING

.1 Demonstrate start up, operation, control, adjustment, trouble-shooting, servicing, shutdown and maintenance of each item of equipment and system.

.2 Identify acceptable tolerances for system adjustments in all operating modes.

.3 Provide procedures for dealing with abnormal conditions and emergency situations for which there is a specified system response.

.4 Complete specific equipment training as prescribed in technical specification sections. Training to include classroom and field training, including troubleshooting and operation of equipment under non-typical operating conditions.

.5 Allow for each training session to be completed two (2) times to accommodate multiple staff shifts.

.6 Allow for multiple trips to conduct training.

.7 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.8 Review operation and maintenance manual in detail to explain all aspects of operation and maintenance.

.9 Prepare and insert additional information in operation and maintenance manual if required.

END OF SECTION

PART 1 – GENERAL

1.1 INTENT OF SECTION

.1 This Section provides the basis for the development of construction sequencing and identifies scheduling and operational constraints that must be taken into account by the Contractor when performing the work.

.2 Alternative sequencing and methods proposed by the Contractor will be considered subject to approval of the Owner and the Consultant and provided that ongoing wastewater treatment system operation can be maintained continuously at all times.

1.2 GENERAL OUTLINE OF PROCEDURES

.1 The following general construction sequence is intended to identify potential constraints to the construction schedule, in order that risks to the existing treatment process and building support systems are reduced and that the existing level of treatment is maintained during the entire construction and commissioning period. The intent of this section is not to identify every constraint that will potentially affect the Contractor's flow of work. Construction scheduling may need to be modified to suit varying and ongoing conditions.

.2 Construct all new works in a manner that minimizes interference with existing processes.

.3 Modifications can proceed with controlled interference to the operation of existing systems. Sewage inflows are to be diverted to temporary bypass pumping system while proposed new works are under construction. Bringing completed works into operation will affect certain operational procedures and these must be discussed with and approved by the Owner and the Consultant before proceeding.

.4 Contractor supplied backup equipment is to be available at all times, unless risk of non-availability has been properly assessed and has been accepted in writing by the Owner and the Consultant. Verify backup equipment operation prior to proceeding with related shutdowns. Documented contingency plans must be in place prior to any operations that may affect existing systems.

.5 The bypass pumping and conveyance systems are to remain available continuously until new systems are tested, commissioned and available for their intended use.

.6 The bypass pumping system is to be equipped with standby power to maintain the required level of service.

.7 Provide automatic monitoring and alarm systems during off-hours, or provide, on-site, competent off-hours supervision.

1.3 RESPONSIBILITIES

.1 Operations staff will only take over responsibility for operating new equipment and systems that have been properly started up, tested, commissioned and trial operated, successfully, including operator training, and accepted in writing by the Consultant and Owner.

.2 Reliance on and acceptance of responsibility for new automatic controls will occur only after the system is properly and fully commissioned (refer to Section 01021).

.3 Contractor is to maintain all new equipment in accordance with the manufacturer's latest written instructions until Substantial Performance. Contractor must keep a maintenance log indicating when

required maintenance has been completed. Breakdowns of new equipment due to faulty installation or lack of due diligence, resulting in spills or unacceptable effluent quality before Substantial Performance, will be the Contractor's responsibility.

.4 Contractor shall be responsible for cleaning all maintenance holes and wet wells affected by Construction and as outlined in the Contract documents.

.5 Contractor to be responsible for operating a Temporary Bypass Pumping System to maintain existing pumping station service levels at all times. Refer to Section 01510.

1.4 COORDINATING CONSTRUCTION WITH OPERATION OF EXISTING FACILITIES

.1 Closely coordinate all activities on site including pipe connections, building connections, electrical connections, and all other interfaces with existing infrastructure with Owner and/or designated representative.

.2 Recognize that the pump station and conveyance systems operate 24 hours per day, seven days per week, 365 days per year. In the event of conflict between construction activities and routine system operations, routine system operations shall always have priority. Avoid interfering with routine system operations and maintenance. Reschedule construction activities, if required, at no change in Contract price.

1.5 SCHEDULING

.1 Contractor to prepare a preliminary schedule of activity that could have an impact on the existing pumping process and building. Note that this scheduling requirement is in addition to requirements outlined in Section 01320 of the specifications.

.2 The schedule is to be updated weekly and include a detailed schedule of activities for the three (3) weeks following. Owner requires a minimum of 1-week notice to arrange, if possible, temporary shutdowns of system processes.

.3 During critical activities, meet each day prior to commencing work to review the day's scheduled activities.

.4 Identify temporary shutdowns or requested operational changes a minimum of thirty (30) days in advance. Fourteen (14) days before the intended shutdown or operational change, define a specific date. Confirm the date and time 72 hours in advance. Owner will review the proposed temporary shutdown or operational change.

.5 For each temporary shutdown, or requested operational change, provide a written plan identifying:
- .1 Length of shutdown.
- .2 Manpower assignment and contact list.
- .3 Material and equipment resources required.
- .4 Contingency plans for equipment or component failure.
- .5 Contingency plans for foreseeable conditions such as power failure, component failure, higher or lower than expected process variables.
- .6 List of all related items to be completed prior to proceeding with the shutdown or process disruption.

.6 Review plan with Owner and Consultant and incorporate comments and required changes.

.7 Prior to commencing work, review plan and inform Consultant and Owner that all required resources are

available. Submit plan allowing sufficient time for Owner to submit to MECP for review, where there is a risk that wastewater treatment system performance may be impaired.

1.6 COOPERATION WITH OTHER CONTRACTORS

.1 Other contractors may be constructing adjacent works to which this Contractor must connect or other contracts may be awarded at the same site.

.2 At the junction points with other contracts, the Contractors shall jointly plan and coordinate their separate work so that the project as a whole will suffer no undue delay, nor will the works be endangered in any way, nor will they suffer improper prosecution at such junction points because of conflict.

1.7 ACCESS TO EXISTING INFRASTRUCTURE

.1 Periodic visits to the existing pumping stations will take place over the duration of the contract. The Contractor will cooperate with the Owner's operations staff in facilitating access in all cases.

1.8 EXISTING FACILITIES

.1 Existing isolation valves and gates may be considered for use by the Contractor to isolate sections of the works.

.2 Owner provides no guarantee that existing equipment is adequate for tight shutoff or suitable for health and safety requirements. The Contractor is to provide additional devices such as blind flanges, sandbagging, etc., as necessary to complete the work.

.3 All valves, gates, etc. are to be operated by Owner staff in cooperation with the Contractor. Both the Contractor and Owner are to provide separate lock out devices on actuators, disconnects, etc. Provide written notice to Owner prior to requesting opening/closing valves or installing/removing gates.

1.9 OFF-HOURS SUPERVISION

.1 The pumping station is generally unattended. Operations staff generally visit the site weekly, or more frequently, as required.

.2 Essential existing equipment functions are monitored and alarmed. Operations staff respond to alarms.

.3 Existing annunciator and alarm system is to be maintained at all times.

.4 Prior to putting new equipment or systems into service, connect, verify and demonstrate to Owner and the Consultant remote alarming as required in the Contract documents.

.5 Following disruption of existing systems and/or equipment, re-verify that alarms and monitoring devices are functioning correctly.

.6 Where critical functions are not monitored to the satisfaction of the Owner, provide competent supervision until such time that work and controls, and monitoring are complete.

.7 In some cases, Owner may request that the Contractor provide on-site attendance during normally

unoccupied periods. In this event, the Contractor is to provide senior staff. Contractor will be compensated for this additional work where all other conditions of the Contract have been satisfied.

.8 Contractor to have senior staff on-call that are able to respond immediately during critical shutdowns or initial operation of equipment where there is a risk to pumping system operations.

1.10 PARTIAL OCCUPANCY OR USE

.1 Owner will consider accepting various upgrades and/or equipment prior to substantial performance. Clearly indicate in the Construction Schedule, any parts of the Work that will be completed and ready for early acceptance.

1.11 GENERAL CONSTRUCTION SEQUENCE

Note: The following construction sequence information is not intended to provide a complete and exhaustive list of the tasks to be undertaken to complete the works, but rather is intended to offer some suggestions on how the work could proceed and to assist the Contractor in understanding the complexity of the overall project. Other variations and options are likely available and can be suggested by the Contractor in order to expedite schedule, reduce costs, minimize disruption, reduce risk, etc. It is, however, paramount that the existing pumping system and associated building systems (where applicable) remain in operation throughout all of the construction period or until such a time as replacement systems are in place and commissioned and with an appropriate amount of continued redundancy.

The General Construction Sequence may not outline the specific equipment testing, commissioning, and operator training requirements. Refer to Section 01021 for related requirements.

Construction of the new infrastructure should be considered as a whole and not necessarily as individual systems. It is important to note that systems interact with each other to some degree and cannot simply be considered “stand alone”. Consideration of the various infrastructure as a whole must be taken into account when assessing construction sequencing and constraints.

Contractor to provide all temporary services required, including but not limited to ventilation, power, fibre, pumping as required to facilitate the Work. The following sequences (and associated constraints) do not include all temporary work that may be required.

Casselman Main Sewage Pumping Station Upgrades:

.1 Submissions, Material and Equipment Delivery
  .1 Submission of required plans prior to onsite work.
  .2 Mobilization to site, pre-survey (incl. buildings) and record of existing conditions.
  .3 Submission of shop drawings and other submittals for review.
  .4 All material and equipment required to complete construction must be readily available to the site (less than one (1) day delivery) or at the project staging area prior to undertaking work on that component at the existing pumping station.

.2 Process mechanical, Heating-Ventilation and Air Conditioning, and Electrical Upgrades
  .1 All mechanical and electrical upgrades to the pumping station shall be coordinated such that specific electrical work is completed before any mechanical equipment is turned live.
  .2 A temporary bypass pumping system shall be installed as required to facilitate process tie-ins at the new and existing header piping, and new sewage pump. During this time, the temporary bypass pumping system is to remain fully operational to facilitate construction and commissioning of the proposed upgrades. Successful commissioning of all constructed upgrades is required prior to

removal of the temporary bypass pumping system.

.3 Two (2) sewage pumps shall be fully operational during any tie-in procedure. Schedule work accordingly.

.4 Ensure that the new forcemain installation and commissioning is complete up to the Pumping Station prior to proceeding with the new sewage pump tie-in.

.5 Ensure that the alum injection line is tied-in to the new forcemain at the Lagoon system prior to proceeding with the new sewage pump tie-in at the Pumping Station.

.6 Ensure that the new sewage pump tie-in is in place prior to performing any work on the motors associated with the existing sewage pump at the Pumping Station.

.7 Coordinate new Electrical room work in parallel with the work items set in 1.11.7.9.

.3 Emergency Overflow Bypass

.1 Prior to construction, contractor shall retain a Geotechnical Engineer to review and incorporate slope stability measures in accordance Section 02315, Item 1.2.

.2 Schedule Overflow Bypass works during low South Nation River levels in the Summer.

.3 Although no in-water works are anticipated as part of these works, follow mitigation measures established by Fisheries and Oceans Canada (DFO). Please refer to DFO Review Letter in Appendix 5 to review these measures.

.4 New Forcemain Alignment

.1 Defer the new forcemain alignment installation within the Stage 3 Protection area between Station 0+000 (Pumping Station) and Station 0+140 until the results and conclusions of a Stage 3 Archaeological Assessment are determined. Schedule work accordingly.

.2 Coordinate Stage 3 Archaeological Assessment with Owners third party Archaeologist as detailed in Section 01561, Item 1.12.

.3 Coordinate with Owner and Operating Authority; Ontario Clean Water Agency (OCWA) for any restrictions during the new forcemain tie-in works at the Pumping Station.

.4 Coordinate with qualified professional for any restrictions on earth work resulting from a Nest and Acoustic survey to mitigate and avoid impacts to species at risk and their habitats.

.5 Install new forcemain up to inlet chamber at lagoon, install new chamber including tees and valves. Test and commission. Ensure that the new sewage pump is installed prior to performing the new forcemain tie-in works at the Pumping Station.

.6 Close new 400mm isolation valve and bypass flow to the lagoon using the two new 150mm tees and 150mm diameter hoses. Complete the connection of the new forcemain to the inlet chamber.

.7 Close 150mm valves and open 400mm valve on new forcemain to convey flow to the inlet chamber using the new forcemain.

.8 Install new chamber, 150mm tees and valves on the existing forcemain. Complete testing on new chamber and valves.

.5 Alum Injection Building and Equipment

.1 Complete the alum building upgrades prior to performing the alum injection line tie-in to the new forcemain at the lagoon.

.2 Ensure that the alum injection line is tied-in to the new forcemain at the Lagoon system prior to proceeding with the new sewage pump tie-in at the Pumping Station.

.6 Forcemain Alignments Tie-in

.1 Ensure that the installation and commissioning of new valve chambers including gate valves for the new forcemain and existing forcemain alignments is complete prior to proceeding with the tie-in before the Splitter Box.

.2 Provide a full contingency plan for shutdown operations for the new forcemain tie-in with the existing forcemain alignment before the Splitter Box at the Lagoon system.

.3 Coordinate with Owner and OCWA to aim for a low flow single night timeframe to complete the tie-in works.

.7 Pumping Station Process Piping, Pumping and Structural Equipment

.1 Construct pump pad and install pump No. P-10301, and install as much process piping as possible without interruption to current operation of the pumping station.

.2 Submit temporary by-pass pumping plan for review.

.3 Set up temporary pumping bypass system to temporarily allow raw sewage to be pumped from the wetwell into the existing forcemain.

.4 Install new header and complete the installation of pump No. P-10301.

.5 Transfer the power and controls (including soft starter) from the existing pump No. P-10101 to the new pump No. P-10301, and perform an initial commissioning of the new pump No. P-10301 with existing soft start.

.6 Ensure operations are resumed and full operation of pumps No. P-10201 and P-10301 before removing the bypass pumping from process.

.7 Install new pump No. P-10101, new motor, new MCCs and VFDs prior to commissioning and reinstate the pump in operation.

.8 Ensure to complete all works on MCCs, VFDs and the new Electrical room (item 1.11.2.7) prior to re-commissioning new pump No. P-10301 with MCC/VFD and reinstatement to operation.

.9 Ensure full operation of new pumps No. P-10101 and P-10301 before removing pump No. 10201 from operation. Once pump No. 10201 is removed from operation, replace existing motor, and install new MCC/VFD.

.10 Coordinate and schedule all 11.1.7 work sequence with 1.11.4 items accordingly.

.8 Final Reinstatement and Close Out Submissions

1.12 TIE-INS AND FLOWS

.1 Construction of the works will include new forcemain connections, and an emergency overflow bypass tie in to sewer manhole. Contractor to schedule work to minimize shut down duration. Operations staff are to be consulted a minimum of one week in advance of any intended tie-ins. Contractor to provide estimated time required for any shutdowns and abide by all operator instructions regarding duration and timing of shutdowns.

1.13 EXCAVATED MATERIAL STOCKPILE AND TESTING

.1 Stockpiled excavated material that does not require sampling may be removed from site. Stockpiled materials that require testing may not be moved or manipulated until the sampling results have been reviewed by the Owner. Once the classification of the soil is known, it can be handled accordingly. Refer to Section 02315 for Off-Site Excavated Surplus Material Disposal requirements.

.2 Mixing soils of different classifications may not occur on site.

.3 Stockpiles are to be protected from accidental or unintentional handling until the soils have been approved for movement.

END OF SECTION

PART 1 - GENERAL

1.1 SETTING OUT

.1 Be responsible for vertical and horizontal control by setting centrelines, batter boards and grade pickets from reference points and benchmarks provided by Consultant. Employ a qualified surveyor to set out and confirm grid lines, elevations, levels, squareness, etc.

.2 Information for established benchmarks on-site to be used by the Contractor for vertical control and layout purposes will be provided prior to starting construction.

1.2 SURVEY PINS

.1 Have property markers, iron pins and square iron bars, disturbed or lost in the course of construction replaced by an Ontario Land Surveyor at no cost to the Owner.

1.3 MINOR LOCATION CHANGES

.1 The Consultant, at their discretion, may direct or approve minor changes requested by Contractor in route or location of new utilities or structures during construction. However, any such change in location shall not be considered as a basis for a claim for extra compensation regardless of reason for changing location.

1.4 EXISTING UTILITIES

.1 Assume full responsibility for protection of known under and above ground utilities, such as water, sewer and gas mains and house connections, hydro and telephone poles, wires and conduits, whether or not they are shown on the plans. Where depth or location of any of these utilities has been shown on the plans, such information is not guaranteed. The Contractor shall be responsible for location of all utilities. All utilities are not necessarily shown on Contract Drawings.

.2 Items encountered below grade not shown on Contract Drawings shall be immediately brought to the attention of the Consultant and/or the Owner.

.3 There are existing overhead and underground utilities throughout the project area, including but not limited to Hydro Ottawa, Enbridge Gas, Bell, watermain, sanitary forcemain. The Contractor is responsible for coordinating their works with all utilities and ensuring that all utilities are supported and protected to the satisfaction of the utility provider.

1.5 OBSTRUCTIONS

.1 Obtain direction from the Owner of utility before exposing, moving or supporting utilities.

.2 Exercise proper caution in excavation and repair and make good at own expense any and all damage done to existing services, provided their location has been shown or staked out substantially correctly.

.3 No payment shall be made for additional work or delays resulting from the presence of structures including pipes, conduits, poles and overhead wires that are known to exist but do not require permanent realignment or relocation, although they may require temporary relocation, support or protection.

.4 No extra compensation shall be made for crossing under or over existing mains or services known to exist that do not require realignment.

1.6 DUST AND DIRT CONTROL

.1 When so requested by Consultant, scrape on-site roads and off-site roadways leading to site clean of earth tracked by construction traffic and hose down. Refer to Section 02370 - Erosion and Sedimentation Control.

1.7 MAINTENANCE OF TRAFFIC

.1 Maintain traffic thoroughfares on construction site including access and route to site.

.2 Bridge open excavations where necessary to maintain traffic on roads and driveways, and provide every facility for pedestrian traffic across and around the excavations.

.3 Maintain traffic on public roadways at all times unless Municipality's permission is obtained to close a road. Notify Police and Fire Department of blockage and detour roads prior to closing road.

.4 All traffic control shall be provided in accordance with the current version of Book 7 of the Ontario Highway Traffic Manual. Traffic control plan shall be provided to the Consultant and Owner for approval prior to any work commencing on municipal roads.

.5 Refer to Section 01520 – Construction Facilities and Temporary Controls.

1.8 OPSD AND OPSS

.1 Various Ontario Provincial Standard Drawings (OPSD) and Ontario Provincial Standard Specifications (OPSS.MUNI) form part of this Contract but are not reproduced herein. The Contractor shall obtain and have a copy of these Drawings and Specifications available on-site for execution of the Work.

.2 All references to measurement for payment in the OPSD and OPSS.MUNI documents do not apply to this Contract. Only items specifically identified in the form of tender as unit rate items will be paid on a unit rate basis.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE.

.1 Not Applicable.

PART 3 - EXECUTION

3.1 NOT APPLICABLE

.1 Not Applicable.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Comply with Division 1 – General Requirements.

.2 Section includes:

- .1 Control of groundwater and surface runoff.
- .2 Pumping, handling, water quality clarification, and discharge of drainage water from construction site.
- .3 Coordinating dewatering work with requirements of other trades and units of work affected by dewatering operations.
- .4 Design, labour, products, equipment and services necessary for dewatering Work in accordance with the Contract Documents.

1.2 REFERENCES

.1 Ontario Provincial Standard Specifications

- .1 OPSS 517 – Construction Specification for Dewatering

1.3 DEFINITIONS

.1 Subgrade:

- .1 Surface to which excavations are made for the purpose of construction of the Work in accordance with the Contract Documents. Subgrade as defined does not include additional depths of excavation that may be required or ordered to obtain suitable foundation conditions.

1.4 SYSTEM DESCRIPTION

.1 Design and Performance Requirements:

- .1 The Contractor shall retain a Professional Hydrogeologist and/or Geotechnical Engineer licensed in the Province of Ontario to design, prepare and oversee the construction and operation of a suitable dewatering system to control ground water and surface run-off on the site to allow for efficient and safe installation of the permanent Works (as necessary to complete the work). Gemtec Consulting Engineers and Scientists Limited is precluded from being retained by the Contractor.
- .2 The Contractor and Contractor's Hydrogeologist and/or Geotechnical Engineer are to review the Geotechnical and Hydrogeological Investigation Report (Gemtec Consulting Engineers and Scientists Limited, 2025) and undertake registering on the provincial Environmental Activity and Sector Registry (EASR) as required.
- .3 The Contractor's Hydrogeologist and/or Geotechnical Engineer shall take full responsibility for the review and interpretation of the factual results of the available Technical Reports and shall determine if any further investigative work is required to prepare a suitable dewatering system. Additional investigation shall be at the Contractor's expense.
- .4 Consider the lateral tracking of groundwater underneath existing structures.
- .5 Select and design dewatering system to control groundwater flows to allow construction to proceed under substantially dry subgrade conditions.
- .6 Design dewatering system so that settlement is not caused by extraction of fine particles from

soil during dewatering. Demonstrate to acceptance of consultant that discharge to surface water meets the required regulations (i.e. Provincial Water Quality Objectives, etc.).

.7 Coordinate the Dewatering Program with the requirements of Section 02315 – Excavation, Trenching and Backfilling, which may include the design and construction of excavation shoring systems, excavation strategies, and backfilling operations. Consider challenges of control of water at the soil-rock interface, where applicable.

.8 Prevent any surface run-off from entering excavations. Construct ditches, berms, extended shaft sheeting, or collar and similar items or other means, as required, to divert water away from excavations. Do not allow silt laden runoff water to enter watercourses, municipal sewer system, pumping station or wastewater treatment plant. Direct runoff flows to siltation ponds or catchment areas before discharging.

.9 Maintain groundwater level at a minimum depth below subgrade level as directed by the Contractor's Hydrogeologist and/or Geotechnical Engineer, to permit placing geotextiles, underdrains, concrete mud mat, Granular Engineered Fill, concrete, and similar items on firm, dry, undisturbed subgrade.

.10 Maintain groundwater at required levels until:

.1 Structure is completely built where designed self-weight of structure resists the buoyancy forces.

.2 Leakage testing is successfully completed for liquid retaining structures, in accordance with applicable specifications and to the satisfaction of the Consultant.

.3 Backfilling to final grade is complete.

.4 Underdrains and other permanent devices which protect the structures against buoyancy are operational.

.11 Prevent destabilization, heaving, or shear failure of the sides and bottom of excavation.

.12 Prevent damage to or displacement of structures from groundwater pressures.

.13 Obtain Consultant's written consent prior to allowing a rise in groundwater level or prior to shutting down of a dewatering operation.

.14 Repair or replace any structure or Works damaged due to dewatering at no expense to the Owner.

.15 Supply standby equipment and power to ensure no disruption to dewatering operations.

.16 Electrically operate equipment, except standby power equipment, to minimize noise impact on adjacent properties.

.2 Dewatering Discharge Requirements:

.1 Discharge water must comply with the MECP EASR and the Ontario Clean Water Agency (OCWA), who are the authorized operator of storm and sanitary sewers within the Municipality of Casselman.

.2 Contractor to determine any requirement for additional treatment prior to discharge.

.3 Have dewatering systems, including discharge and abandonment, comply with requirements of Ontario Water Resources Act (OWRA) and other relevant legislation.

.4 The Contractor shall be responsible for monitoring all construction dewatering activities and complying with all EASR requirements.

.5 The Contractor shall comply with the applicable Fisheries Timing Windows where no in-stream works or discharging to the South Nation River shall be conducted outside of the July 16 to September 30 window.

.6 Under no circumstances is the dewatering discharge to be directed to the sanitary sewer system, South Nation River, pumping station or wastewater treatment plant.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Dewatering Program:

.1 The Contractor's Hydrogeologist and/or Geotechnical Engineer shall be responsible for the preparation of the Dewatering Program which will be submitted in the form of a Plan document.

.2 The Dewatering Program must be stamped by a Professional Engineer and/or Hydrogeologist licenced in the province of Ontario.

.3 The Dewatering Program must outline location and dimensions of the Contractor's proposed pre-treatment measures, such as fractionation tanks, dewatering bags, settling basins, or other treatment facilities to remove suspended solids before discharging to municipal sewers, or roadside ditches.

.4 The Dewatering Program must include a proposed layout of the pre-treatment measures, as well as a maintenance schedule.

.5 Demonstrate to acceptance of Consultant that dewatering system is functioning in accordance with design requirements in advance of excavation.

.6 The Dewatering Program must include a contingency plan that will be implemented if the proposed pre-treatment measures fail to adequately remove suspended solids.

.7 The Dewatering Program must indicate the location of generators and other noise-producing equipment with anticipated decibel levels, dewatering discharge and monitoring points, groundwater observation wells, and siltation ponds with dimensions and filter media specifications, as required.

.8 The Dewatering Program shall be coordinated with the Contractor's Settlement and Groundwater Monitoring Plan prepared in accordance with Section 02450.

.9 The Dewatering Plan must demonstrate that it will meet the requirements of the EASR, specifically but not limited to the quantity of dewatering.

.10 The Dewatering Program submitted in the form of a Plan document must be approved by the Consultant, prior to the Contractor mobilizing to site. Allow a minimum of 14 days for review of the Dewatering Program submittal.

.11 The Dewatering Program must include the following:

.1 The definition of turbid water as any discharge water or diverted water with a maximum increase of 5 nephelometric turbidity units (NTUs) above the receiving watercourse's background levels. Where no background sample is available, turbid water shall be defined as any discharge water with a total suspended solids (TSS) concentration of 25 mg/L for watercourses.

.2 The Contractor's commitment not to discharge turbid water to any watercourse, municipal sewer, roadside ditches, pumping station or wastewater treatment plant. In addition, if the discharge water appears turbid, dewatering operations must cease immediately, and pre-treatment measures must be modified to enhance settling and filtration of suspended sediment, in accordance with the Contractor's contingency plan.

.3 The Contractor's Hydrogeologist and/or Geotechnical Engineer's acknowledgement that it has read, and that the Dewatering Program will comply with, all terms and conditions of the MECP EASR. Contractor to include cost for any additional on-site investigation required to prepare the Dewatering Program Plan.

.4 Turbidity sampling locations and frequency (minimum of once per day at discharge point and background sampling location during active dewatering). Discharge water to watercourse must be shown to be within the limits for all parameters listed in the EASR. All sampling and laboratory analysis will be conducted at the Contractor's own expense. All test results will be provided to the Consultant for review as soon as they are available.

.2 Pre-Condition Survey

.1 Perform a pre-condition survey, in accordance with Section 01110 – Summary of Work, of all existing structures located within 125 metres of any well used to temporarily control groundwater levels. The survey is to document with photographs, drawings and measurements, the condition

of existing structures. This survey will be used for assessment of any damage to existing structures.

.3 Reports:

.1 Measure and record, on a form accepted by the Consultant, total daily groundwater and drainage water discharge to each municipal sewer, ditch and/or watercourse resulting from temporary dewatering activities. Submit copies of records to the Consultant on a weekly basis.

.4 Permits:

.1 Contractor shall not draw water in excess of 50,000 L/d unless it is monitored according to EASR requirements.

.2 Contractor shall arrange and pay for an EASR from the MECP. The Contractor is to review and incorporate this into their dewatering plan.

.3 Comply with requirements with respect to discharge sampling, testing, flow measurement, record keeping, and other requirements required by the MECP. Submit copies of records to the Consultant. Contractor is responsible for measuring and recording quantity of water taken from the site.

.4 The Contractor is required to comply with permit from the South Nation Conservation Authority.

1.6 QUALITY ASSURANCE

.1 Qualifications:

.1 The Contractor shall engage the services of a specialist dewatering contractor who has a minimum of 8 years of experience in the design and construction of dewatering systems for projects of similar size and complexity.

.2 The Contractor, the Contractor's Hydrogeologist and/or Geotechnical Engineer, and the dewatering contractor shall be responsible for the design, supply, installation and overall operation of the dewatering program and shall demonstrate sufficient previous project experience to suit the site-specific constraints associated with this project. To meet this requirement, the Contractor and their design engineers shall provide a minimum of (3) project examples in the past ten years from municipal water or wastewater facilities with dewatering rates ±25% of the anticipated rates for this project.

1.7 SITE CONDITIONS

.1 Examine the Geotechnical and Hydrogeological Investigation Report by Gemtec Consulting Engineers and Scientists Limited and included in the tender package.

.2 Determine if additional on-site investigation is required and include costs for such investigations and time within schedule.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Dewatering Equipment:

.1 Supply all temporary pipes, wells, deep wells, well-points, pumps, electrical generators, and other equipment required to facilitate Dewatering Program.

.2 Supply treatment equipment as required to comply with the discharge water quality requirements

from the EASR, Sewer Use By-Law and any other Authority having jurisdiction.

.3 Supply all temporary standby pumps and a generator with effective muffling devices to keep noise levels within limits acceptable to the Owner required to facilitate Dewatering Program.

PART 3 - EXECUTION

3.1 GENERAL CONSTRUCTION AND EXCAVATION SEQUENCE

.1 Sequencing of excavation activities shall proceed in accordance with Division 1 and the Contractor's Excavation and Backfilling Plan prepared in accordance with Section 02315.

.2 Contractor shall prevent inflow from sewer and yard piping excavations into the excavation.

.3 All excavation, trenching, installation and backfilling shall proceed in sections, in order to limit dewatering inflow.

.4 Install clay trench barriers as indicated on the Civil Drawings, to mitigate groundwater inflow in the trenches.

3.2 PREPARATION

.1 Intercept and direct surface water away from excavations and monitoring equipment by use of dikes, curb walls, ditches, pipes, sumps or other means to existing storm drainage system to Consultant's and local authorities' acceptance.

3.3 INSTALLATION

.1 Install dewatering equipment and dewater to required levels before proceeding to excavate.

.2 When required to sub-excavate because of unsuitable subgrade condition, dewater and monitor effectiveness of dewatering before proceeding to sub-excavate.

.3 Take corrective measures as required to maintain groundwater at a sufficiently low level to meet performance requirements.

.4 For installations outside of excavations, install dewatering system in covered trenches. Install shored trenches for pipes, headers and other dewatering equipment and cover if necessary, or protect by acceptable means.

.5 Cover shored trenches and/or chambers constructed to house dewatering equipment with firmly secured steel plates matching existing adjacent surface grades to withstand construction loads. Maintain installation for the duration of the work.

.6 During duration of operation, maintain dewatering systems safely to prevent hazard to public and in accordance with regulations and requirements of authorities having jurisdiction.

.7 Ensure dewatering systems are sufficiently insulated and protected for winter operation, if required by the Construction Schedule.

.8 Clearly identify dewatering equipment locations and provide barricades as required to ensure worker and public safety.

.9 Locate existing underground utilities and make provisions in dewatering system installation to accommodate any utility conflicts or interferences.

.10 Coordinate work with relevant utility companies and authorities having jurisdiction.

.11 Remove covers and shoring from trenches and chambers for dewatering operation, promptly backfill and restore surfaces to original condition. Match adjacent surfaces, in accordance with requirements of authorities having jurisdiction.

.12 If sewer becomes blocked or has its capacity restricted as a result of dewatering operation, arrange and pay for cleaning with jurisdictional agency.

.13 Flotation of Structures:

.1 Maintain groundwater at sufficiently low levels to prevent damage or displacement of structures by groundwater pressures.

.2 Protect completed structures or part of completed structures which would suffer displacement or other damage as a result of dewatering equipment failure by providing:

.1 Standby dewatering equipment, connected directly to electrical generators, engaging automatically in case of power failure.

.2 A positive means by which the structures may be flooded with water to neutralize exterior hydraulic pressures.

.3 A combination of the two alternatives above.

.14 Design and Operate Dewatering Systems:

.1 To prevent loss of ground as water is removed.

.2 To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.

.3 To relieve artesian pressures and resultant uplift of excavation bottom.

.15 Standby power and equipment:

.1 Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

3.4 DEWATERING

.1 Supply, install and operate additional dewatering measures necessary to carry out work.

.2 Install filters, settling ponds, or similar installations to remove particulate matter. Until clearance of soil particles occurs, store water to allow sedimentation prior to discharge into appropriate sewer or roadside ditch.

.3 Dispose of precipitation and drainage water away and clear of Work area. Keep excavation dry.

.4 Maintain continuous and complete effectiveness of installation including taking measures to prevent clogging of suction screens. Supply and install sufficient back-up pumping and power equipment to maintain uninterrupted operation.

.5 During backfilling maintain water level at such elevations to prevent flotation of structure. Continue with temporary dewatering measures until permanent drainage system is working and operational to the satisfaction of the Consultant.

3.5 DRAINAGE AND EXCAVATED AREAS

.1 Supply, install and maintain ditches of adequate size to intercept and collect surface and subsurface water and seepage which may enter excavations and divert water into sump to be drained or pumped into drainage channels as indicated on shop drawings.

.2 Grade bottom of excavation for water to flow to filtered sumps and prevent water from ponding on excavation bottom.

.3 Pre-filter groundwater before discharge. Filter at bottom of well to prevent pumping of fines. Perform additional surface filtering where necessary to limit particulates being discharged to Sewer Use By-Law requirements.

3.6 MONITORING GROUNDWATER WELLS

.1 Five monitoring wells are available for use by the Contractor as determined by the Dewatering Program. Refer to Geotechnical and Hydrogeological Report for approximate location of the monitoring wells.

.2 Install and monitor observation wells as required by Dewatering Program. Construct wells in accordance with Ontario Regulation 903. Measure water levels observed in each observation well as per Dewatering Program and at least weekly and whenever system or component failures are discovered and whenever any event, including but not limited to flood, storms, changes in water surface elevation of nearby water bodies, may have caused a change in the groundwater elevation.

.3 After groundwater level observation wells are no longer needed for monitoring groundwater levels, observation wells are to be properly decommissioned. The well abandonment method must satisfy the minimum requirements of Ontario Regulation 903 as amended by Ontario Regulation 128/03. The Contractor shall provide a copy of the written well record (for the abandonment) to the Consultant.

.4 After groundwater level observation wells are no longer needed for monitoring groundwater levels, abandon observation wells, as required by regulations.

3.7 DISPOSAL OF WATER

.1 Discharging any surface water or groundwater into the pumping station or sanitary sewer system shall not be permitted.

.2 Treat water collected by dewatering operations, as required by the EASR, prior to discharge to roadside ditches. If water does not meet regulatory limits additional treatment of water on-site or off-site is required.

.3 Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.

.4 Remove solids from temporary treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.

3.8 PROTECTION OF PROPERTY

.1 Monitor for settlement of nearby structures in accordance with Section 02450 – Settlement, Vibration and Groundwater Monitoring.

.2 Make assessment of potential for dewatering induced settlement. Provide and operate devices or systems, including but not limited to reinjection wells, infiltration trenches, and cutoff walls, necessary to prevent damage to existing facilities, completed Work, and adjacent property.

.3 Securely support existing facilities, completed Work, and adjacent property vulnerable to settlement due to dewatering operations. Support shall include, but not be limited to, bracing, underpinning, or compaction grouting.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This section pertains to the rock breakage by mechanical means for the construction of new sanitary overflow pipe, sanitary forcemain and associated maintenance holes, chambers and connections.

.2 The contractor shall supply personnel, equipment, materials, services and supervision required to excavate bedrock, using mechanical methods, for site services, sewers, forcemains, conduit trenches, pumping station and other requirements, as necessary to complete the Work described by the plans and specifications.

.3 Blasting is not permitted. It is expected that rock excavation will be completed using a hoe ram or rock splitters in conjunction with line drilling and/or pre-drilling.

.4 The work of this section shall be completed in accordance with Section 02315 – Excavation, Trenching and Backfilling and Section 02450 – Settlement, Vibration and Groundwater Monitoring.

1.2 DEFINITIONS

.1 Rock: any solid material in excess of 0.5 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with 1.15 m^3 bucket. Frozen material is not classified as rock.

.2 Hoe-Ram: A powerful percussion hammer fitted to an excavator for demolishing concrete structures or rock.

.3 Line-drilling: A single row of unloaded, very closely spaced holes drilled along the perimeter of the excavation.

1.3 REFERENCE STANDARDS

.1 OSHA, R.R.O. 1990, Regulation 854 Mines and Mining Plants.

.2 Union Gas Construction and Maintenance Manual Sections 3.10, 11.3, 12.6, 17.5 and 17.11

.3 Ontario Provincial Standard Specification OPSS.MUNI 403 – Rock Excavation for Pipelines, Utilities and Associated Structures in Open Cut.

1.4 GEOTECHNICAL REPORT

.1 Refer to the Geotechnical and Hydrogeological Report prepared by Gemtec Consulting Engineers and Scientists Limited for the preparation of mechanical rock breakage.

1.5 PRICE AND PAYMENT PROCEDURES

.1 Although the contract is lump sum, rock removal will be paid at the unit rate established in the form of Tender.

.2 Should the final quantity of rock removal be less than 75% of the quantity shown in the Form of

Tender the Contractor shall be entitled to adjust their unit rate. No rate changes will be permitted for additional rock removal.

.3 Prior to commencing rock removal, Contractor to excavate down to bedrock surface and provide a survey of the rock profile for the purpose of determining rock quantities. Depending on the Contractor's project sequencing, multiple surveys may be required to capture the full site. Where multiple surveys are undertaken, the survey data should be compiled into a single document for completeness.

1.6 QUALITY ASSURANCE

.1 Contractor shall retain a vibration-monitoring Consultant to establish and implement vibration monitoring criteria associated with rock excavation operations before construction in accordance with Section 02450 – Vibration, Settlement and Groundwater Monitoring.

.2 The Contractor shall maintain complete and accurate records of rock excavation operations. Submit records to the Consultant weekly and provide monthly summaries.

1.7 SUBMITTALS

.1 Submittals in accordance with Division 1.

.2 Submit written proposal of operations for removal of rock by mechanical methods to Consultant. This should be included as part of the Excavation and Backfill Plan submission under Section 02315 – Excavation, Trenching and Backfilling.

.3 Submit Vibration Monitoring Plan under Section 02450 – Settlement, Vibration and Groundwater Monitoring.

.4 Submit pre-excavation survey of rock profile to determine rock quantities for payment.

.5 Submit results of pre-condition survey in accordance with Division 1.

.6 Submit post-excavation survey of rock profile.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.9 PROTECTION OF EXISTING FEATURES

.1 Protect existing features in accordance with applicable local regulations.

.2 Existing buried utilities and structures:

.1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing excavation work, notify applicable owner or authorities having jurisdiction to establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.5 Where utility lines or structures exist in area of excavation, obtain direction of Consultant before removing or re-routing.

.6 Record location of maintained, re-routed and abandoned underground lines.

.3 Existing buildings and surface features:

.1 Protect existing buildings, services and surface features from damage while work is in progress. In the event of damage, immediately make repair to Consultant's satisfaction.

.2 Perform a pre-condition survey of all existing structures located within 125 metres of the site in accordance with Division 1. The survey is to document with photographs, drawings and measurements, the condition of existing structures. This survey will be used for assessment of any damage to existing structures.

PART 2 - PRODUCTS

2.1 ROCK REMOVAL PRODUCTS

.1 Rock removal shall be completed via non-explosive methods.

.2 Select equipment to carry out the rock removal to ensure that vibration peak particle velocities (PPVs) are less than those stipulated in Section 02450 – Settlement, Vibration and Groundwater Monitoring.

PART 3 - EXECUTION

3.1 DRILLING

.1 The drilling sub-contractor shall control their drilling operations, through the use of proper equipment and techniques in order to space and align drill holes. The drill pattern is to be designed for the rock geology identified in the geotechnical report. No hole shall deviate from the plane of the planned backslope by more than 150 mm.

.2 The depth of holes shall be established to respect the final grade and/or design lines. The costs related to overdrilling shall be the responsibility of the contractor.

.3 The drilling pattern shall be adopted to the varying geological conditions and the type of excavation.

3.2 ROCK REMOVAL

.1 Perform excavation in accordance with Contractor's Erosion and Sedimentation Control Plan, Excavation Backfill Plan, Dewatering Plan and Vibration Monitoring Plan.

.2 Coordinate this Section with the health and safety requirements of Division 1.

.3 Remove rock to alignments, profiles, and cross sections as indicated.

.4 Explosive blasting is not permitted.

.5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak and avoid damage to adjacent structures.

.6 Where vertical bedrock walls greater than 1 metre in height will be located within the zone of influence of the existing foundations (i.e., down and out from the existing footing at a slope of 1 horizontal to 1 vertical), the Contractor's Geotechnical Engineer shall review the condition of the rock mass prior to proceeding deeper than this depth with the bedrock excavation.

.7 Where the excavation extends deeper than 1.8 metres into the bedrock, near vertical walls shall be reviewed by the Contractor's Geotechnical Engineer for any sign of unstable pillars or slabs that should be removed or stabilized.

.8 Excavate trenches to lines and grades to accommodate the specified minimum bedding requirements for each particular service.

.9 Cut trenches to widths as indicated.

.10 Remove boulders and fragments which may slide or roll into excavated areas.

.11 Correct unauthorized rock removal at no extra cost, in accordance with backfilling requirements specified in Section 02315 – Excavating, Trenching and Backfilling.

3.3 ROCK RE-USE

.1 Contractor to submit to Consultant, for review and approval, a plan to re-use any rock on site in accordance with the Geotechnical Report. Provide details on how rock will be processed to become an acceptable fill material. Indicate where the fill will be used on the site, including proposed volumes.

3.4 CLEANING

.1 Clean in accordance with Division 1.

.2 Rock Disposal:
- .1 Unless approved for re-use, dispose of removed rock off site in accordance with Division 1.
- .2 Do not dispose removed rock into landfill. Send material to appropriate location as approved by Consultant.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

.1 Test pits have been included in this project for the purpose of verifying the location, size, material, alignment, and geodetic elevation of important existing buried infrastructure within the project limits. Before construction of the sanitary forcemain begins the Contractor shall be required to prove the location, alignment, and geodetic elevations of the existing sanitary forcemain at all crossings and structures. These include, but are not limited to, the following below locations:

- Existing Drain Chamber at Sta. 0+300
- Crossing of existing forcemain at Sta. 0+960
- Existing Bell underground line between Sta. 0+960 to 1+185
- Existing Drain Chamber at Sta 1+130
- Existing alum line between Sta. 1+260 to 1+320
- Crossing of existing Lagoon outlet at Sta 1+655
- Existing MH and outlets at Sta. 1+970
- Existing stub at the splitter box near Sta. 2+013
- Additional four (4) locations as directed by the Consultant

1.2 SUBMITTALS

.1 The location and depth of pipes/ducts shall be proven by the Contractor and the information provided to the Consultant as soon as the test pits have been completed.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE.

.1 Not Applicable.

PART 3 - EXECUTION

3.1 METHOD

.1 The method for completing all test pits shall be at the Contractor’s discretion; however, the approach selected shall be suitable to protect existing buried utilities/infrastructure and to gather/measure the information that is necessary. If in the opinion of the Consultant or site representative, the method(s) employed by the Contractor jeopardizes the integrity of existing buried utilities/infrastructure, or will not allow the necessary information to be properly measured/gathered, the Contractor shall be required to change their approach at no additional cost.

.2 In all instances, the test pits shall be of sufficient size and depth to measure, confirm, and record all necessary information. This information shall be measured and recorded by the Contractor and immediately provided to the Consultant. The horizontal and vertical position of exposed utilities shall be measured by the Contractor using Total Station Survey (not GPS).

.3 Upon completion, test pits are to be backfilled and reinstated pending final restoration. Where the test pit is performed within an asphalt surface, the Contractor shall reinstate asphalt that is removed or damaged by the excavation work, as directed by the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

.1 Close cut clearing consists of cutting off or removing at or near flush with original ground surface standing trees, brush, scrub, roots, stumps and embedded logs and disposing of fallen timber and surface debris.

.2 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees and disposing of felled trees and debris.

.3 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of all fallen timber and surface debris.

.4 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments to not less than a specified depth below original ground surface.

1.2 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, benchmarks, existing buildings, existing pavement, utility lines, site appurtenances, and root systems of trees which are to remain. Restore any damage to existing or better condition.

.2 Do not apply tree paint to cuts or scars suffered by vegetation designated to remain.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Equipment appropriate to perform work as specified.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect site and verify with the Consultant the items which are designated to remain.

.2 Locate and protect above and below grade utility lines. Preserve in operating condition active utilities traversing site.

.3 Notify utility authorities before starting.

.4 Unless otherwise noted, Contractor is responsible for obtaining permits required for clearing and grubbing works. Contractor to coordinate the completion of the work with all affected parties and conform to all requirements identified in the permit.

.5 The timing of clearing and grubbing works shall comply with applicable timing windows per Section 01561 – Environmental Procedures, or as per MNRF, MECP, and local conservation authority requirements.

.6 Prior to clearing and grubbing works, Contractor shall provide for review a Nest and Acoustic Survey completed by a qualified professional.

3.2 CLEARING

.1 Clear brush and trees not designated to remain on site.

.2 Cut off trees to a height of 300 mm above ground.

.3 Remove trees and shrubs to extents to permit the Works.

.4 Strip vegetation and topsoil where forcemain alignment is to be constructed.

3.3 GRUBBING

.1 Grub out stumps and roots as needed to permit the Works.

3.4 REMOVAL AND DISPOSAL

.1 Remove and dispose of cleared and grubbed materials off site per Section 01355 – Construction/Demolition Waste Management and Disposal.

3.5 FINISHED SURFACE

.1 Leave ground surface in condition suitable for construction operation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D6938-17, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.2 EXISTING CONDITIONS

.1 Known underground and surface utility lines and buried objects are to be assumed as indicated on site plan. The location of utilities is approximate only. The exact location should be determined by consulting the municipal authorities and utility companies concerned. The Contractor is responsible for confirming the location of all existing utilities and existing utility services.

.2 Contractor to obtain utility locates at time of construction, prior to any excavation.

1.3 PROTECTION

.1 Protect and/or transplant existing trees, benchmarks, buildings, surface or underground utility lines which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

.3 Contractor will be responsible for removing any soil or debris on municipal roadways caused by Contractor's operations at their own cost.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fill material: Type in accordance with Section 02315 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Consultant, in accordance with the Geotechnical Report and the Contractor’s Soil Management Plan.

PART 3 - EXECUTION

3.1 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Commence topsoil stripping of areas after area has been cleared of brush, weeds and grasses and removed from site.

.3 Strip topsoil to depths as indicated.

.4 Avoid mixing topsoil with subsoil.

.5 Stockpile in locations as indicated by Consultant, in accordance with the Geotechnical Report and the Contractor's Soil Management Plan. Stockpile height not to exceed 2 m.

.6 Dispose of unused topsoil as directed by Consultant, in accordance with the Geotechnical Report and the Contractor's Soil Management Plan.

3.2 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to the following depths after compaction, below finish grades, unless otherwise noted:
- .1 150 mm for grassed areas.
- .2 250 mm for gravel paving.

.3 Slope rough grade away from building 1:100 minimum.

.4 Grade ditches to depth as indicated.

.5 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.

.6 Compact filled and disturbed areas to Standard Proctor maximum dry density, as follows (unless otherwise noted):
- .1 95% under landscaped areas.
- .2 100% under paved and walk areas.
- .3 If required per Contractor's Geotechnical Engineer, areas to be compacted to higher Standard Proctor maximum dry density.

.7 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 TESTING

.1 Inspection and testing of soil compaction for Quality Assurance (QA) purposes will be carried out by testing laboratory appointed by Owner. Costs of testing to be paid through the materials testing cash allowance. Refer to Division 1.

3.4 SURPLUS MATERIAL

.1 Refer to Section 02315 – Excavation, Trenching and Backfilling

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 OPSS.MUNI 180 Management of Excess Materials.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM D6938-15, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

.3 Geotechnical and Hydrogeological Investigation Report, Casselman Main Pumping Station Upgrades, Casselman, Ontario, File No. 100117.051, prepared by: Gemtec Consulting Engineers and Scientists Limited., dated January 6, 2025.

.4 Soil Screening Report, Casselman Main Sewage Pumping Station Upgrades, Casselman, Ontario, File No. 100117.051, prepared by: Gemtec Consulting Engineers and Scientists Limited, dated January 13, 2025.

.5 Ontario Regulation 406/19: On-site and Excess Soil Management as amended by Ontario Regulation 775/20: On-site and Excess Soil Management.

.6 Ministry of the Environment, Conservation and Parks (MECP): Rules for Soil Management and Excess Soil Quality Standards (Soil Rules).

1.2 EXCAVATION AND BACKFILLING PLAN

.1 Contractor to retain a Professional Geotechnical Engineer licensed in the Province of Ontario to plan and design all required site excavations, temporary granular pads for equipment, temporary support systems, and backfilling operations to facilitate proper installation of the required Works and in accordance with the Contract Documents.

.1 The following firm is precluded from being retained by the Contractor: Gemtec Consulting Engineers and Scientists Limited.

.2 The Contractor’s Geotechnical Engineer is to review and understand the factual results of the existing available Technical Reports, assess the adequacy of the information and undertake additional field investigations, if required and at the Contractor’s expense.

.3 The Excavation and Backfilling Plan shall include, as a minimum:

.1 A description of construction techniques, slope protection measures, equipment, schedule and sequencing.

.2 Slope stability measures for the proposed equipment, and construction methodology that will not adversely impact the stability of slopes with respect to the South Nation River for the construction of the emergency overflow pipe at the SPS Plant.

.3 Stamped design excavation drawings indicating excavation footprints, excavation grades and elevations, erosion and sedimentation control measures, backfill material profiles and elevations, pipe bedding and insulation details, and shoring and bracing designs, all as required to facilitate installation of the required Works

.4 Contractor shall include a description of cold weather procedures to protect earthworks.

.4 The Excavation and Backfilling Plan shall address all requirements of the current Occupational Health & Safety Act (OHSA) Regulations.

.5 The Excavation and Backfilling plan shall be coordinated with the Contractor's Settlement and Vibration Monitoring plan prepared as per Section 02450.

.6 The Excavation and Backfilling plan shall be coordinated with the Contractor's Dewatering plan prepared as per Section 02140.

.7 The Excavation and Backfilling plan shall be coordinated with the Contractor's Erosion and Sedimentation Control Plan as per Section 02370.

.8 The Excavation and Backfilling plan shall be submitted for review and approval by the Consultant at least fourteen (14) days prior to any excavation work proceeding.

1.3 OFF-SITE EXCAVATED SURPLUS MATERIAL DISPOSAL

.1 General:
- .1 The Project will require registration as described under Section 8 of O.Reg. 406/19.
- .2 The qualified quantity of excess soil for disposal at a beneficial re-use site is an upset limit of 2,400 m^3.
- .3 Once the upset limit has been met, the Municipality will accept additional generated excess soils at the Lagoons site for beneficial re-use within the site.
- .4 Conduct additional testing of excess soil to confirm beneficial re-use application at the Municipality's Lagoon property.
- .5 Refer to the noted Gemtec reports in Section 1.1 of this specification for additional details.

.2 OPSS 180.MUNI shall apply except as amended and extended herein.

.3 All references to Regulation 347 of the Environmental Protection Act (EPA) shall be replaced with Regulation 347/558, Regulation 406/19 and Regulation 775/20.

.4 QP as used herein, means (Contractor's) Qualified Person as defined in Ontario Regulation 153/04, Records of Site Condition - Part XV.1 of the EPA, Section 5 and Ontario Regulation 406/19.

.5 Subsection 180.07.05 of OPSS180 is amended by the addition of the following:

1. Areas of Contamination

.1 "Contaminated" material is defined as material, which exceeds the MECP Table 3 Standards. Material which exceeds Table 1 standards, but which meets Table 3 standards is not considered "contaminated" unless it cannot be preferentially re-used on site and a suitable alternate receiving site cannot be identified. Similarly, excess material, which satisfies any of the Excess Soil Quality Standard (ESQS) Tables 2.1 through 9.1 is not considered "contaminated" unless it cannot be preferentially re-used on site or a suitable alternate receiving site cannot be identified. Material where the "contamination" is strictly limited to elevated naturally occurring compounds (such as metals in clay) is not considered contaminated unless it cannot be preferentially re-used on site or a suitable alternate receiving site cannot be identified. It is clarified that "contaminated" soil pertains only to the layer and extents of soil that has been positively identified through testing as having exceedances of applicable comparative regulatory standards, and not necessarily the entire strata of soil layers at the testing location.

.2 Excess soil with Electrical Conductivity and Sodium Adsorption Ratio exceedances attributed to road salt is not considered contaminated for the purposes of offsite reuse and the Contractor shall beneficially reuse this material at a suitable alternate receiving

site and not haul it to a landfill as 'contaminated soil'. No additional payment will be considered for preferentially re-using salt-impacted soil on-site or disposing of it off-site as the work is deemed incidental to the Contract.

.3 The Contractor shall notify the Contract Administrator immediately if contaminated materials are encountered or suspected during construction.

2. Management of Excavated Soil

1. The Contractor shall implement risk management measures (RMMs) to mitigate potential exposure to contaminants during excavation and backfill activities. Measures shall be put in place to minimize soil and wind erosion when the excavated material is stockpiled. Additionally, RMMs are recommended for construction workers to mitigate potential risks and include the use of personal protective equipment (PPE) (e.g., safety boots, long sleeve shirts and long pants, safety glasses, and chemical resistant gloves) and the use of a photoionization detector (PID) to measure vapor concentrations in air in the excavation prior to entry or other measures as may be recommended by the Contractor's QP.

2. The Contractor shall be responsible for retaining a QP to provide all the necessary services as outlined herein.

3. The Contractor's operation shall:

    1. Sample the excavated material and stockpiled areas and determine the type of material that is present.
    2. Separate the layers of soil from the adjacent layers by reuse type to avoid mixing soil types of different reuse potential.
    3. Separate the existing pavement structure from adjacent soil layers for preferential re-use on site.
    4. Preferentially reuse geotechnically suitable soils with lower off-site reuse potential onsite to avoid offsite disposal.
    5. Remove offsite and properly dispose of excess material when excavating or when material is deemed to be unsuitable for use as backfill during the installation of structures, sewers, watermains, and services. The geotechnical suitability of the fill material is to be confirmed by the Contractor's QP.

3. Soil Management Plan

.1 The Contractor shall submit an acceptable Soil Management Plan (SMP) prepared and certified by their QP twenty (20) Working Days prior to starting excavation. The SMP must be developed by a QP in accordance with all applicable regulations. The SMP shall clearly contain the following, including but not limited to:

.1 Construction staging approach and methodology proposed by the Contractor that will meet the requirements outlined herein for dealing with the management of excavated and excess soil.

.2 A soil sampling and testing program must be developed by the Contractor's QP. The sampling and testing program must include:

.1 Delineating the boundaries of the identified areas of contamination referenced in this special provision.

.2 Supplemental sampling and testing by the QP as necessary to classify soils within the project limits and identify layers of contaminated material or varying reuse potential.

.3 Sufficient sampling and testing to comply with applicable soil management

Regulations and the requirements of the designated Receiving site(s).

.2 The procedures for soil sampling and laboratory analysis are to ensure conformance with all applicable regulatory and Contract requirements.

.3 Conformance with the requirements outlined in the MECP document “Rules For Soil Management and Excess Soil Quality Standards” as amended and, where not superseded by the aforementioned document, conformance with the recommended best management practices outlined in the MECP document "Management of Excess Soil – A Guide for Best Management Practices", as amended.

.4 Temporary soil (contaminated and unimpacted) storage locations and measures to mitigate impacts to human health and the environment.

.5 Measures to mitigate contaminant dispersion from stockpiles (i.e., stockpiling away from storm drains or water courses, use of tarps as cover, use of berms to prevent runoff from leaving the area, etc.).

.6 How the requirements of Regulation 406/19 will be met.

.7 Contingency plan to be followed if hazardous material, as it pertains to O.Reg. 347/558, is encountered on site.

.8 Measures to keep contaminated soil off private property adjacent to the work.

.9 Provision of adequate forms and documentation, in a timely manner to the Contract Administrator, to support that each haulage to the landfill contains excess contaminated material and has been authorized by the QP and CA. Include date and time, truck I.D., soil analyses, weigh bill and any other pertinent information.

.10 Identify an alternative receiving site for excess material that exceeds MECP Table 1 standards, but are below MECP Table 3 standards and ESQS Tables 3.1.

.11 Identify an alternative receiving site for excess material with elevated naturally occurring compounds (such as metals in clay).

.12 Certification by the QP that site generated materials being transported off-site will not have detrimental impacts to the receiving environment.

.2 All excess soil not subject to landfilling shall be disposed of in accordance with all applicable regulations.

.3 The Contractor shall ensure that unimpacted native materials or imported materials such as select subgrade or temporary/permanent roadway granulars are not mixed with contaminated fill material that is to be removed.

4. Management of Excess Soil

.1 It is anticipated that excess soil will be generated as a result of the construction. The Contractor shall schedule and conduct construction activities as per the following conditions:

.1 If soils meeting the definition of “contaminated” as defined herein are encountered that cannot be preferentially re-used on site or beneficially disposed at a suitable alternate receiving site, the excess “contaminated” soil excavated must be removed off site for disposal at Licensed Landfill. The Contractor shall undertake Reg. 347 testing to classify the soil as non-hazardous prior to hauling to the landfill. The Contractor shall also undertake TCLP testing, which must be reviewed by the Licensed Landfill before acceptance of contaminated material will be accepted.

.2 The Contractor will be required to provide a detailed list of all trucks that will be used to haul contaminated material. The Contractor shall be responsible for coordination with the landfill scale house including notification of haul vehicles.

.2 The Contractor is advised that recent excess soil regulations require additional documentation for haul trucks. It shall be the Contractor’s responsibility to ensure that all haul trucks follow documentation requirements for the new excess soil regulations. The

Contractor shall transport contaminated soils using trucks and drivers that are duly licensed by the MECP as a waste hauler.

.3 All potential costs associated with acquiring approvals, releases, confirmation testing (including Reg. 347 and Regulation 406 classification testing), and coordination to obtain agreements shall be included in the Contract price for the work.

.4 Costs associate with Toxicity Characteristic Leaching Procedure (TCLP) testing and tipping fees for contaminated soil will be considered a change to the Contract, if the soil must be disposed of at a Licenced Landfill.

.5 The Contractor shall be responsible for all costs associated with the management of excess contaminated soil and the removal of excess contaminated material including but not limited to testing of the excavated material, trucking and disposal of excess contaminated soil material at the Landfill (excluding tipping fees), reduction in production rates due to the presence of contaminated material, penalties and clean-up costs in the event of infractions by the Contractor.

.6 The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the excess soil material.

.7 The off-site disposal, including excavation, handling, hauling, and disposal costs (excluding tipping fees at Licensed Landfill) of all surplus soils are the responsibility of the Contractor. No additional compensation shall be provided for the management of non-contaminated materials onsite as backfill or management and offsite removal of excess non-contaminated materials as disposable fill/recycling or beneficial reuse as this work shall be considered incidental to the Contract.

.8 A copy of a completed Site Fill Placement Agreement Acknowledgement Form shall be submitted to the Owner prior to the use of properties other than the project site for the management of material as surplus fill using Form 02315-A.

.9 A Fill Management Plan prepared in accordance with MECP publication “Management of Excess Soil – A Guide for Best Practices” and meeting the requirements of Regulation 406/19 as amended for the receiving site is to be submitted to the Owner for each receiving site.

.10 Copies of the Notification and approval documentation are to be provided to the Consultant and property owner a minimum of two weeks prior to the commencement of such work.

.11 The Contractor shall provide the Owner and Consultant their Site Fill Placement Agreement Acknowledgement Forms(s) of their proposed excess soil receiving site(s) no less than 15 Working Days in advance of transport of soils off of the project site.

.12 The Contractor shall provide the Owner and Consultant a copy of the proposed receiving site’s Fill Management Plan and a release letter signed by the Owner of the receiving site no less than 15 Working Days in advance of transport of soils off of the project site to the proposed receiving site. The release letter shall be in a form approved by the Owner.

.13 The Owner may, at their sole discretion, reject any proposed receiving site(s) at any time and request that one or more alternatives be identified.

.14 Excess soil must be transported directly from the project site to the receiving site and must not be temporarily stored at any other location, or otherwise altered, prior to delivery to the receiving site.

.15 Soils shipped from site cannot be returned to site.

.16 The Contractor shall obtain a final summary of total volume or tonnage of soil accepted by the receiving site(s). This summary shall be provided to the Owner within 10 Working Days of completion of off-site movement of the soils to the receiving site.

1.4 QUALITY ASSURANCE TESTS AND INSPECTIONS

.1 Quality Assurance Testing and Inspection of materials and compaction of backfill and subgrades will be carried out by testing laboratory designated by the Owner and coordinated by the Contractor. Contractor to ensure own Quality Control for all compaction and materials prior to requesting Quality Assurance testing by Owner.

.2 Do not begin backfilling or filling operations until material has been approved for use by Consultant.

.3 Not later than 48 hours before backfilling or filling with approved material, notify Consultant and coordinate designated Testing agency so that compaction tests can be carried out.

.4 Before commencing work, conduct, with Consultant, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey benchmarks and monuments which may be affected by work. Prepare report and submit prior to undertaking Works.

.5 Shoring and Bracing

.1 The Contractor is responsible for reviewing the installation of the temporary shoring and bracing system. The Contractor is also responsible for monitoring the performance of the shoring and bracing system during use. Contractor shall make any adjustments, repairs or replacement of the shoring and bracing system to ensure a stable excavation is maintained.

.6 Management of Liquids

.1 Groundwater removed from excavations shall not be allowed to discharge, either directly or via overland flow, to water bodies, or to any street or storm sewer without prior written approval from the Environment Inspector.

.2 All liquid waste materials transported off-site for disposal must be appropriately manifested as per applicable law.

.7 Spills and Encountering of Unexpected and Hazardous Conditions

.1 The Contractor shall take all reasonable precautions to prevent spills and shall maintain spill response supplies and ability commensurate with the fuels, oils and other construction materials in use or stored on site during the project. No storage of fuels, hydraulic oils or lubricants, or fuelling or maintenance of equipment shall be permitted within 10 metres of any open water or a storm sewer catch basin.

.2 If a spill occurs the Contractor must take all reasonable actions to prevent migration and notify the Ministry of Ministry of the Environment, Conservation and Parks Spills Action Centre (SAC) at 1-800-268-6060 and the Environmental Inspector or other representatives of the Municipality as soon as possible.

1.5 BURIED SERVICES

.1 Before commencing work, verify and establish the location of all buried services on and adjacent to the site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.

.3 Remove obsolete buried services within 2m of foundations. Cap cut-offs.

.4 Record location and elevation of all existing services exposed during execution of the Works.

1.6 PROTECTION OF EXISTING FEATURES

.1 Protect existing features in accordance with applicable local regulations.

.2 Existing buried utilities and structures:

- .1 Size, depth, and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .2 Prior to commencing excavation Work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
- .3 Confirm locations of buried utilities by careful test excavations.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone, telecom and other utilities and structures encountered.
- .5 Record location of maintained, re-routed, and abandoned underground lines.
- .6 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:

- .1 Protect existing buildings and surface features from damage while Work is in progress. In the event of damage, immediately make repair to Consultant's approval.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular 'A' with properties to Section 02701 - Aggregates.

.2 Granular 'B' (Type I) with properties to Section 02701 - Aggregates.

.3 Granular 'B' (Type II) with properties to Section 02701 - Aggregates.

.4 Geotextiles: Woven Class II, as per Section 02948 – Geotextiles.

.5 Service Marker Tape:

- .1 Tape to be detectable poly tape with aluminum backing, SETON Tape product numbers.
- .2 Product Numbers to match service:
  - .1 Sewers: product number 85502.
  - .2 Watermain: product number 85504.

.3 Electrical cables: as per Division 16.
.4 Gas: product number 85499.

.6 Type ML Clay Soil: Fine Grained soil (>50% No. 200 US Sieve size with liquid limit <50) made up of inorganic silts, silty, or clayey fine sands, with slight plasticity (<20 plasticity index). Type ML Soil as per the Unified Soil Classification System. This soil is also to meet requirements of Inert fill as described by current Provincial legislation (granulars, clean concrete, clean limestone rock).

.7 Engineered Fill: Imported well-graded, crushed, compactable, granular soils, free of organics and other deleterious materials. Granular 'A' or 'B' as described above would qualify as suitable materials.

.8 Clean Fill: Soil, sampled and analyzed in accordance with the requirements of Schedule E of O.Reg. 153/04, as amended, under the supervision of a Qualified Person. As specified by the Regulation, samples shall be collected and analyzed at a frequency of one sample per 160 cubic metres of soil for the first 5,000 cubic metres to be brought to the site, and one sample for each additional 300 cubic metres of soils. Documentation of soil sampling and analyses shall be provided to the Owner at least 10 Working Days prior to importing the soil. The documentation shall be in the form of a written report signed and sealed by the Qualified Person who supervised the work. The Owner may, at its sole discretion, reject the proposed soil imports. Imported Soil must meet the current "Table 1" MECP background standards (most recently published), as the "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act.

PART 3 - EXECUTION

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

.3 Establish all required temporary measures for Erosion and Sedimentation Control for the work intended and include in the Excavation and Backfilling Plan.

3.2 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Construct temporary works to depths, heights and locations as per approved Excavation and Backfilling Plan and Dewatering Program.

.2 Excavation and backfilling operations to be carried out under the supervision of the Contractor's Geotechnical Engineer.

.3 During backfill operation:
.1 Unless otherwise as indicated or as directed by Contractor's Geotechnical Engineer, remove sheeting and shoring from excavations.
.2 Do not remove bracing until backfilling has reached respective levels of such bracing.
.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500mm above toe of sheeting.

.4 When sheeting is required to remain in place, cut off tops at elevations as indicated in the Contractor's Excavation and Backfilling Plan. Record location and elevation of remaining sheeting.

.5 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore water courses as indicated and as directed by Contractor's Geotechnical Engineer.

3.3 CLEARING AND GRUBBING

.1 Refer to Section 02231 – Clearing and Grubbing.

3.4 GENERAL EXCAVATION

.1 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil. Stockpile topsoil for later use. Topsoil is not suitable as engineered fill and should only be re-used for landscaping applications.

.2 Excavate for slabs and paving to subgrade levels in accordance with the approved Backfilling and Excavation Plan. In addition, remove all topsoil, organic matter, debris, and other loose and harmful matter encountered at subgrade level.

.3 Excavate to lines, grades, elevations, and dimensions as required to facilitate construction of the works and as per the Excavation and Backfilling plan.

.4 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation.

.5 Excavation must not interfere with bearing capacity of adjacent foundations.

.6 For trench excavation, unless otherwise authorized by Consultant in writing, do not excavate more than 20m of trench in advance of installation operations and do not leave open more than 10m at end of day's operation.

.7 Keep excavated and stockpiled materials a safe distance away from edge of trench in accordance with OHSA requirements and the Contractor's Geotechnical Consultant.

.8 Restrict vehicle operations directly adjacent to open trenches.

.9 Dispose of surplus and unsuitable excavated material off site.

.10 Do not obstruct flow of surface drainage or natural watercourses.

.11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.12 Notify the Contractor's Geotechnical Engineer when bottom of excavation is reached. Contact testing and inspection agency to provide quality assurance of subgrades prior to placement of material.

.13 Obtain the Contractor's Geotechnical Engineer's approval of completed excavation.

.14 Contractor shall employ appropriate methods to protect the approved subgrade from disturbance of any kind, including from freezing.

.15 Remove unsuitable material from trench bottom to extent and depth as directed by the Consultant.

.16 Correct unauthorized over-excavation as follows:

.1 All costs resulting from unauthorized over-excavation are entirely the responsibility of the Contractor.

.2 Unless otherwise noted below or elsewhere, unauthorized over-excavation is to be corrected through the placement of compacted Granular 'B', to the approval of the Contractor's Geotechnical Engineer.

.3 For service trenching, over-excavation is to be corrected with Granular 'A' compacted to 100% Standard Proctor maximum dry density in maximum 150mm lifts.

.17 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.18 If, during grading or temporary excavation activities, evidence of unknown conditions or environmental contamination is identified, the Contractor shall cease work in the area and notify the Owner. The area must be assessed under the supervision of the Owner or Consultant to determine if additional soil, groundwater, or sediment testing is required in accordance with governing regulations and standard industry practices. Evidence of environmental contamination includes such observations as:

.1 soil staining or other unnatural soil colours;

.2 unusual odours emanating from soil, groundwater or sediment;

.3 petroleum sheen or free product on the surface of water; and

.4 previously unidentified buried debris.

3.5 SOILS MANAGEMENT

.1 Contractor is responsible for the excavation, handling, hauling, and disposal costs of all soils excavated as part of the Work.

.2 Soils excavated on-site will consist of:

.1 Clean fill (granulars, clean concrete, clean limestone rock).

.2 Excess soils.

.1 Topsoil - means those horizons in a soil profile, commonly known as the "O" and the "A" horizons, containing organic material and includes deposits of partially decomposed organic matter such as peat.

.2 Beneficial Reuse Soils - Soils that have a beneficial reuse onsite (source site). This soil may also have a beneficial reuse at a 3rd party receiver site to be identified by the contractor.

.3 Waste soils.

.1 Solid Non-hazardous Waste – Soils not re-used directly onsite (source site), having chemical or other characteristics that exceed site criteria standards, or contain "waste" as described in Ontario Regulation 347. Waste soils must be transported and disposed of at a licensed landfill facility or transfer station. The Contractor shall provide the name of the MECP licensed disposal facility and the number of its Environmental Compliance Approval or Certificate of Approval to the Owner and Consultant using the Site Selection Notification Form Site Fill Placement Agreement Acknowledgement Form prior to removing the soils from site.

.4 Costs associated with management of soils/excess soils is to be included as part of the contracted amount.

.3 Re-Use of Salt-Impacted Excess Soil

.1 Salt-Impacted Excess Soil may be re-used where approved by the Consultant and Contractor's Geotechnical Engineer.

.2 Salt-Impacted Excess Soil may only be placed:

.1 Where it is reasonable to expect that the soil will be affected by the same chemicals as a result of continued application of a substance for the safety of vehicular or pedestrian traffic under conditions of snow or ice; or

.2 With an industrial or commercial property use and to which non-potable water standards would be applicable; or

.3 That is at least 1.5 m below the surface of the soil.

.3 Salt-Impacted Excess Soil shall not be placed:

.1 Within 30 m of a waterbody;

.2 Within 100 m of a potable water well or area with an intended property use that may require a potable water well; or

.3 In lands that will be used for growing crops or pasturing livestock unless the excess soil is placed 1.5 m or greater below the soil surface.

3.6 FILL TYPES AND COMPACTION

.1 Unless noted otherwise, use fill types and compaction rates as specified below. Compaction densities are percentages of Standard Proctor maximum dry densities obtained from ASTM D 2922.

.1 Exterior side of foundations, retaining and tank walls within 0.6m of the wall surface: use Granular 'B' type II fill to subgrade level. Compact to 95% under landscaped areas or 98% under pavement or exterior slabs.

.2 Within building area: use Granular 'A' to underside of base course for floor slabs. Compact to 100%.

.3 Under concrete slabs: provide 200mm compacted thickness base course of Granular 'A' fill. Compact base course to 100%.

3.7 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact fine aggregates for bedding and surround of underground services to 98% SPMDD.

.2 Place bedding and surround material in unfrozen condition.

.3 Place marker tape as detailed on drawings on top of bedding.

3.8 BACKFILLING

.1 Do not proceed with backfilling operations until Contractor's Geotechnical Engineer has inspected and approved installations and quality assurance is completed by Testing and Inspection agency.

.2 Areas to be backfilled to be 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 Place backfill material in uniform layers not exceeding 200mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations.
- .1 Place bedding and surround material as specified elsewhere.
- .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
- .3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
  - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Consultant or Geotechnical Engineer:

.6 Install drainage system in backfill as indicated.

.7 Contractor shall employ appropriate methods to protect the engineered fill from disturbance of any kind, including from freezing.

3.9 EROSION AND SEDIMENTATION CONTROL

.1 Refer to Section 02370 – Erosion and Sedimentation Control

.2 The Contractor shall create and maintain records and submit them monthly to the Owner all activities related to soil movements at the site including:
- .1 dates and duration of work;
- .2 weather and site conditions;
- .3 location and depth of excavation activities;
- .4 erosion and sediment control measures employed;
- .5 dust control measures employed;
- .6 stockpile management and drainage;
- .7 soil characterization results;
- .8 names of any involved Qualified Persons, Subcontractors, haulers and receiving sites for any soil removed from the Property; and
- .9 any complaints received relating to site activities.

3.10 RESTORATION

.1 Upon completion of Work, remove waste materials, and debris. Trim slopes and correct defects as directed by Consultant.

.2 Replace topsoil as indicated.

.3 Reinstate lawns to elevation which existed before excavation, unless specified otherwise.

.4 Reinstate pavements disturbed by excavation to thickness, structure and elevation which existed before excavation, unless specified otherwise.

.5 Reinstate granular roadways (e.g. Lagoon site access road) disturbed by excavation to thickness, structure and elevation which existed before excavation, unless specified otherwise.

.6 Clean and reinstate areas affected by Work to satisfaction of Owner.

END OF SECTION

The following describes the notification process between the Owner of the Contract and the Contractor, wherein the Contractor formally notifies the Owner that agreement has been reached with a third party property owner for the disposition of Contract generated excess material. Such excess material managed as disposable fill, shall be limited to one of or a combination of: earth; aggregate; rock, provided the conditions on management are satisfied.

Site Information

Property Owner(s) for the subject property: _____

The subject property:

Lot _____, Concession ____, Township of _____

County/Region/District of _____, Estimated Quantity and Type of Excess Material used as fill:

_____

_____

This is to notify you, as Owner, that permission has been obtained from the property owner(s) named herein for the management of excess materials from this Contract. The property owner has also been provided with a copy of this form and has been advised that a Property Owner's Release Form, 02315-C, will be required. The use of this management site will comply with the following:

Conditions on Management

Bituminous pavement, concrete, masonry, wood which has been treated, coated or glued, and metal, plastic, and polystyrene products will not be accepted for management as disposable fill. Disposable fill will be top covered by a minimum of 300 mm of earth.

These conditions do not supersede any constraints imposed on this property by Federal, Provincial or Municipal statute or regulations and by-laws made thereto.

Dated this ___ day of _____ 20__

_____
Print Contractor's Name & Field Representative's Name

_____
Contractor's Field Representative Signature

_____
Property Owner(s) Signature(s)

Work Description: _____

_____

I/We_____being the owner(s) of Lot _____, Concession _____

Township of_____, and County/Region/District of_____,
verify that the Contractor for the above noted work has placed excess material from the above noted Contract on my/our property with my/our permission. I/We have been advised the Contractor of the "Conditions on Management" described in Form 002315A_____or 002315B_____, respectively, or both, and have been assured by the Contractor that these conditions have been met.

Where materials are managed as disposable fill, I/We agree to be responsible for any subsequent relocation and management of the material so placed.

Where materials were stockpiled, I/We agree that the stockpile(s) have been removed by the date(s) herein noted.

We are satisfied that my/our property has been reinstated to my/our satisfaction.

Dated this____day of_____20__

_____

Print Contractor's Name & Field Representative's Name

_____

Contractor's Field Representative Signature

_____

Property Owner(s) Signature(s)

PART 1 - GENERAL

1.1 OBJECTIVES OF EROSION AND SEDIMENTATION PLAN

.1 Prevent the loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.

.2 Prevent the sedimentation of storm sewers and receiving streams during construction.

.3 Prevent air pollution from dust and particulate matter during construction activities.

1.2 SUBMISSIONS

.1 Contractor to submit an Erosion and Sedimentation Control (ESC) Plan in advance of all site excavations, including control type, placement, installation/removal sequence. The ESC Plan is to include provisions for dust control, administrative controls for all sources of sediment movement, and collection and disposal of captured sediment.

.2 Submission of the ESC Plan is a mandatory requirement for the application of a SNCA Permit for works in proximity of the South Nation River. The Contractor is to submit the ESC Plan to the Consultant for initial review. The accepted ESC Plan can then be submitted to the South Nation Conservation Authority (SNCA) for final review and permit approval.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Silt Fence Fabric:
  .1 Fabric to be woven and comply with OPSS.MUNI 1860.07.05.03

.2 Geotextile
  .1 Geotextile to be woven Class II as per OPSS.MUNI 1860.

.3 Miscellaneous ESC Material
  .1 Other miscellaneous ESC materials as per OPSS 805.MUNI or approved ESC Plan.

PART 3 - EXECUTION

3.1 SITE-WIDE PRACTICES

.1 Contractor is to keep the main access road(s) clear of any mud or earth tracked from vehicles.

.2 All vehicles moving granular, earth, rock, or topsoil materials are to have their loads covered prior to leaving the site.

.3 No mud or earth may be tracked onto public roads or the site access road(s)at any time.

.4 Where possible, avoid construction activities that may produce dust on windy days.

.5 All stockpiles of excavated materials or imported granular materials are to be stabilized according to the expected length of time without disturbance as detailed in this section and as per OPSS.MUNI 805.

.6 Dust Control:
- .1 Dust Control measures are to be as per OPSS.MUNI 506.
- .2 Dust suppressants other than water or calcium chloride (flake or solution) require prior approval. Provide data as per OPSS.MUNI 506.04.01

3.2 INSTALLATION OF ESC MEASURES

.1 Installation of the ESC measures is to be conducted in such a way that downstream measures (those measures closest to watercourse to be protected) are to be installed prior to upstream measures.

.2 All Structural Measures for a given work area are to be installed prior to any construction work.

.3 Structural Measures
- .1 Structural measures are to be installed as per the contractors approved ESC Plan.
- .2 Silt Fence
  - .1 Silt fence to be installed as per OPSD 219.110.
  - .2 Contractor may elect to place 200 mm of granular material on the upstream side to anchor the foot of the silt fence as opposed to excavating to secure the foot.
  - .3 Contractor to ensure that the foot of the silt fence is secured throughout the silt fence length.
- .3 Straw Bale Flow Check
  - .1 Straw Bale Flow Checks to be installed as per OPSD 219.180.
  - .2 Contractor to ensure that the flow check is seated a minimum of 75 mm below the surrounding surface.
  - .3 All excavated materials to be placed upstream of the flow check.
- .4 Temporary Rock Flow Check – V-Ditch
  - .1 Rock Flow Checks to be installed as per OPSD 219.210.
  - .2 Contractor to ensure that a minimum of 300 mm of geotextile is securely seated a minimum of 200 mm below the surrounding surface.
  - .3 Any excavated materials to be placed upstream of the flow check.
- .5 Stabilization Measures
  - .1 Cleared and graded areas that will undergo no further construction are to be stabilized within 14 days. Where possible, final planting should progress as soon as conditions permit. Temporary stabilization measures are to be used until final planting is conducted.
  - .2 Cleared and graded areas where construction activities will cease for at least 21 days are to be stabilized no later than 14 days after the last activity using temporary stabilization measures.
  - .3 All areas of final planting are to be protected similarly to existing tree protection. Any loss of tree material is to be replaced.
  - .4 All onsite areas to be used for Contractor laydown, trailers, or parking, are to be cleared, stripped topsoil to be removed. The area is to be covered with geotextile and a minimum surface of 150 mm Granular ‘A’ compacted to 95% of Standard Proctor Maximum Dry Density. Geotextile and Granular ‘A’ to be removed as part of the Contractor’s restoration activities. Exposed soils to be finish graded as per construction drawings.

.5 All offsite areas to be used for Contractor laydown areas, trailers, or parking are to be covered with geotextile and a minimum surface of 150 mm of Granular 'A' compacted to 95% of Standard Proctor Maximum Dry Density. Removal of the Granular 'A' and geotextile to be completed at the end of the project. Exposed soils are to be scarified and seeded.

.6 Temporary Stabilization Measures

.1 Contractor is to be aware that any contamination of stockpiled material or of graded surfaces by temporary stabilization method is to be resolved at the Contractor's expense.

.2 Temporary Seeding

.1 Temporary Seeding is to be performed as per permanent hydraulic seeding.

.2 Areas to be temporarily seeded are to have the soil surface loosened prior to seeding.

.3 Mulch is to be used to cover the seed as directed by the Consultant.

.3 Mulching

.1 Mulching can be used to stabilize areas with steeper gradients.

.2 Hay, straw, woodchips can be used as mulch for temporary seeding, or as a stabilization method.

.4 Covering

.1 Areas can be covered by tarps or other fabric materials to prevent dust and erosion.

.2 Contractor is responsible to ensure that any covering material remains whole and is securely fastened down.

.7 Sedimentation Prevention Measures

.1 Catch Basin Lid Filter Cloth

.1 All catch basins and catch basin manholes are to have a double layer of geotextile placed under their lids to prevent sedimentation of the storm sewer system.

.2 Protection of Existing Vegetation

.1 Trees to be preserved are to be isolated from construction activities through the use of tree protection fencing as per OPSD 220.010 – Barrier for Tree Protection.

.2 Construction activities are to minimize disturbance to grassed areas. Any grassed areas to be used for construction activities are to be cleared and stripped and topsoil is to be stockpiled. Areas are to be stabilized after construction activities are complete.

.8 Ditch Inlet Protection

.1 All ditch inlets are to be protected by a straw bale flow check immediately upstream of the ditch inlet, until all areas draining into the ditch inlet have been permanently stabilized.

.2 All ditch inlets are to have a double layer of geotextile placed under their lids to prevent sedimentation of the storm sewer system.

3.3 INSPECTION OF ESC MEASURES

.1 Once a week, or immediately after any rainfall event of at least 12 mm, each ESC measure onsite is to be inspected in its entirety. All ESC measures are to be maintained in good working order.

.2 Contractor shall complete the ESC Inspection Forms in Section 02370A during each inspection.

.3 If any maintenance, repairs or replacement are to be made to an ESC measure, the work is to be initiated within 24 hours of report.

.4 Inspection of Structural Measures

.1 Silt fence

.1 Silt fence is to be inspected for: depth of embedment, tears or holes, erosion around or under the fence, sagging or collapse.

.2 Sediment accumulation reaching 1/3 fence height is to be removed and relocated to areas onsite of low erosion potential.

.2 Rock or Straw Bale Flow Checks

.1 Flow Checks are to be inspected for: collapse, rotting bales, exposed geotextile, erosion underneath or around the check, and sediment accumulation.

.2 Sediment accumulation reaching 1/2 height is to be removed and relocated to areas onsite of low erosion potential.

.5 All stormwater system structures (ditch inlets, catch basins, maintenance holes, oil/grit separators) are to have the geotextile inspected for tears, holes and the structure sumps (if applicable) are to be inspected for accumulated sediment. Sediment to be removed if more than 1/3 full of sediment. Collected sediment is to be properly disposed of offsite.

.6 All geotextiles are to be inspected for tears and holes. Where used in contact with the soil, the matting is to be in continuous contact with the soil.

.7 All seeded or planted areas are to be inspected to ensure vegetative growth. Where vegetation has washed away, or died off, additional seeding is to be applied. Ensure area has sufficient water to promote growth.

.8 Material stockpiles are to be reviewed to ensure that erosion and dust control measures are in place and in good material condition. Make repairs as required.

3.4 ESC MEASURE REMOVALS

.1 After all upstream construction work has been completed, including the removal of upstream ESC measures, all areas have been permanently stabilized according to the Civil Drawings, and if approved by the Consultant, the ESC measure may be removed.

.2 All accumulated sediment at the ESC measure is to be removed.

END OF SECTION

**SCHEDULE A: EROSION AND SEDIMENTATION CONTROL (ESC)
INSPECTION CHECKLIST**

Project Name: _____

Completed By: _____

Date: _____

During Construction: Complete this checklist on a weekly basis as per Section 02370. For each measure, check the “OK” box if there are no repairs or maintenance required; check the “Not OK” box if attention is required as per the inspection/maintenance procedures in the specification. For all measures marked as “Not OK”, the Inspection Log must be completed. List the measures that are deficient in the “Deficiencies” column on the Log, and record the maintenance performed. Submit both the checklist and the log to the Consultant on a monthly basis after all maintenance activities have been completed and recorded.

ESC MEASURE	Location on Site	OK	Not OK

SCHEDULE B: EROSION AND SEDIMENTATION CONTROL (ESC)
Weekly Inspection Log

Log Start Date: _____

Log End Date: _____

Log Complete By: _____

Project Name: _____

Company: _____

Telephone No: _____

Inspection Date	General Observations (e.g., Seasonal Conditions)	Location and Deficiency of ESC Measure	Corrective Measures	Initials

I hereby certify that the information provided is complete, correct, and complies with the requirements of Section 02370.

Signature	Title	Date

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCE

.1 OPSS.MUNI 1004 – Material Specification Aggregates – Miscellaneous.

.2 OPSS.MUNI 1860 – Material Specification for Geotextiles

.3 OPSS.MUNI 511 – Construction Specification for Rip-Rap, Rock Protection, and Granular Sheeting

.4 OPSD 810.010 – General Rip-Rap Layout for Sewer and Culvert Outlets

PART 2 - PRODUCTS

2.1 STONE

.1 Hard, dense, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution:

.1 R-10 Gradation (Table 8, OPSS.MUNI 1004)

100%	<15 kg
70-90%	<10 kg
40-55%	<5 kg
0-15%	<0.5 kg

.2 R-50 Gradation (Table 8, OPSS.MUNI 1004)

100%	<75 kg
70-90%	<50 kg
40-55%	<25 kg
0-15%	<2.5 kg

2.2 GEOTEXTILE FILTER

.1 Geotextile: Nonwoven, Class II according to OPSS 1860, with an FOS of 75-150 µm (Terrafix or approved equivalent).

.2 Refer to Section 02948 – Geotextiles.

PART 3 - EXECUTION

3.1 PLACING

.1 Where rip-rap is to be placed on slopes, excavate area at toe of slope to dimensions as indicated.

.2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.3 Place geotextile on prepared surface as indicated and per Section 02948 - Geotextiles.

.1 Geotextile shall be fixed to prevent movement during installation. Geotextile shall be wrapped down to the ground by 300mm minimum at termination points. Avoid puncturing or folding geotextile. Vehicular traffic over geotextile is not permitted

.4 Place rip-rap to thickness and details as indicated.

.5 Place stones in manner approved by Consultant to secure surface and create a stable mass. Place larger stones at bottom of slopes.

.6 Hand placing:
- .1 Use larger stones for lower courses and as headers for subsequent courses.
- .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
- .3 Finish surface evenly, free of large openings and neat in appearance.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 This section covers site-wide settlement, vibration and groundwater level monitoring for nearby structures which are either sensitive to settlement and vibrations during construction activities or which may be affected by construction activities (e.g., excavation and dewatering) or groundwater lowering during construction.

.2 Rock excavation is anticipated to be required as part of the proposed works. Settlement and vibration monitoring is therefore required for nearby structures, including the existing sanitary forcemain and associated maintenance holes and chambers, which are either sensitive to vibrations during construction activities or which may be affected by construction activities (e.g., excavation and dewatering).

.3 The Contractor shall be responsible for monitoring all structures that are in place in proximity to removal and excavation works.

1.2 REFERENCES

.1 Reference Standards:
- .1 Ontario Provincial Standard Specifications
  - .1 OPSS 539 – Construction Specifications for Temporary Protection Systems
- .2 Ontario Ministry of the Environment, Conservation and Parks (MECP) / Ontario Clean Water Agency (OCWA)
  - .1 O.Reg. 169/03 – Ontario Drinking Water Quality Standards
- .3 Canadian Foundation Engineering Manual, Current Edition

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Work Meetings:
- .1 Convene pre-installation meeting one (1) week prior to beginning work of this Section with Owner and Consultant to:
  - .1 Verify project requirements.
  - .2 Verify existing site conditions adjacent to removal work.
  - .3 Discuss the Settlement, Vibration Monitoring Plan and coordinate with Owner regarding locations of monitoring devices.
  - .4 Coordination with other construction sub trades.
- .2 Should alert levels be met, the Contractor shall convene a meeting to discuss rectification of the issue.
- .3 Ensure key personnel (Site Supervisor, Owner, Consultant, Project Manager and Subcontractor Representatives) attend.
- .4 Consultant will provide written notification of change to meeting schedule established upon contract award and 24 hours prior to scheduled meeting.

1.4 SUBMITTALS

.1 Submit in accordance with Division 01.

.2 Settlement, Vibration, Groundwater Monitoring Plan

.1 At least two (2) weeks in advance of construction, the Contractor shall submit a detailed Settlement and Vibration Monitoring Plan, sealed by a Professional Engineer licensed in the Province of Ontario, for review by the Consultant. This plan must be implemented in advance of any construction or removal work being undertaken. This shall include:
   .1 A detailed pre-construction survey of structures in areas where settlement/vibration monitoring is required. Any existing interior/exterior structural deficiencies (such as cracks) in the structures shall be identified during this pre-construction survey as well as the methodology for how these will be monitored during construction.
   .2 A description of the scope of the monitoring program and the methodology required to meet the plan's objectives.
   .3 Communication methodology for exceedances.
   .4 Settlement monitoring requirements:
      .1 Locations of settlement monitors (with the types and locations of survey monuments used for the settlement monitoring specified).
      .2 Location, description and elevation of settlement monitoring benchmarks.
      .3 Survey staff and equipment for settlement monitoring (with achievable tolerances).
      .4 Frequency of settlement readings and data logging, including approach for logging.
      .5 Proposed monitor triggering and precautionary measures to be employed
      .6 Approach if the settlement or vibration readings exceeds acceptable limits.
   .5 Vibration monitoring requirements:
      .1 Submit CVs of key individuals. Qualifications of the Specialist Sub-Contactor include minimum five (5) years of experience completing projects of similar size, scope and complexity. A minimum of five (5) projects shall be identified.
      .2 Identification of the individual(s), and their contact information, designated to oversee the vibration monitoring system(s); and the daily recording of activities required in this specification.
      .3 Detailed description of the vibration monitoring system and if necessary, catalog cuts of monitoring equipment that will be used; how the equipment will be calibrated and recalibrated if necessary during the life of the project including calibration certificates; description and schematics if necessary of how the independent components will function as a system.
      .4 Methodology confirming placement of vibration monitors relative to the construction (i.e., monitors which are relocated to follow current construction activities or the use of more monitors which do not need to be moved as often).
      .5 Method of Instrumentation and installation on the site.
      .6 Locations of vibration monitoring.
      .7 Frequency of vibration readings and data logging, including approach for logging.
      .8 Proposed monitor triggering and precautionary measures to be employed.
      .9 Approach if the settlement or vibration readings exceeds acceptable limits.
   .6 Included in the Settlement, Vibration, Groundwater Monitoring Plan shall be the Contractor's Contingency Plan which provides the mitigation and response plan for potential exceedances of the Review Limit assigned for total and differential settlement or the Vibration Limits specified. The Contingency plan shall include how the Contractor will first address the exceedance (such as immediately stopping all settlement/vibration inducing work and increasing monitoring frequency) and then how they will alter their construction methodology to ensure that no further settlement or vibration beyond the limit occurs.

.2 Once the plan has been implemented, the Contractor shall provide weekly monitoring reports to the Consultant detailing settlement, vibration and groundwater readings. Reports shall be provided immediately if limits are exceeded. Information to be required in the Monitoring Reports shall include:
   .1 A written description of the monitoring activities completed that week.
   .2 The date(s) and time(s) of all monitoring activities carried out.
   .3 Survey grade control elevations taken that week on the settlement monitoring points including an

historical tabulation of all shots taken since the establishment of the points.

.4 Changes to vibration monitoring locations to reflect construction progress.

.5 A statement indicating that the results of the monitoring show that the risks of settlement/vibration of adjacent structures are within acceptable tolerances and construction practices as established on site can continue.

.6 Groundwater elevations at monitoring wells taken that week including an historical tabulation of all shots taken since the establishment of the monitoring.

1.5 QUALITY ASSURANCE

.1 Qualifications:

.1 The settlement monitoring shall be conducted by a specialist sub-contractor with a minimum of five (5) years of experience in Ontario.

.2 The vibration monitoring shall be conducted by a specialist sub-contractor with a minimum of five (5) years of experience in Ontario carrying out vibration monitoring and vibration studies.

1.6 MEASUREMENT FOR PAYMENT

.1 Settlement, Vibration, and Groundwater Monitoring Plan shall be as a lump sum, all inclusive, in accordance with the following payment schedule:

.1 25% upon submission and acceptance of the Monitoring Plan

.2 50% upon completion of all construction work

.3 25% upon receipt and acceptance of post-construction final reporting.

.2 Measurement for payment for Settlement, Vibration, and Groundwater Level Monitoring shall be per each week during which vibration, settlement and groundwater level monitoring is ongoing, and includes all equipment, material and personnel to perform the monitoring, as well as weekly reports to the Consultant.

.3 The installation and removal of settlement monitors (including reinstatement due to destructive monitoring techniques such as anchor pins in foundations / foundation patching and parging) is deemed incidental to the work and no separate payment will be made.

.4 The Contractor is responsible for notifying the Consultant of when settlement/vibration/groundwater level monitoring is ongoing and when settlement/vibration/groundwater level monitoring is not occurring. Note that payments for monitoring will be withheld until such time as all Reports have been provided up to the cut-off date for the progress payment.

1.7 PRIVATE PROPERTY CONSENT

.1 The Contractor is to be aware that the structures being monitored are located on private property. As such, the Contractor shall obtain consent from the property owners to enter and perform any vibration monitoring work prior to proceeding.

.2 The Contractor is solely responsible for coordinating directly with property owners and ensuring that any necessary legal arrangements and/or insurance are in place prior to carrying out the work.

.3 The Contractor shall note any owners which refuse consent in their Plan submission.

.4 The Contractor shall continue pursuing consent until consent either is or is not granted by the property

owner.

PART 2 - PRODUCTS

2.1 VIBRATION MONITORING EQUIPMENT

.1 Vibration monitoring shall be carried out using an Instantel Minimate Plus seismograph or an approved equivalent capable of monitoring on a continuous basis and providing peak levels at regular intervals (no greater than 5 minutes), as well as full waveform data.

.2 The vibration monitoring equipment shall be capable of measuring vibration intensities up to 254 mm/s at a frequency response of 2 to 250 Hz.

.3 The vibration monitor shall be equipped with a real time warning system consisting of either a red flashing light or an air horn alert when the threshold value is reached.

.4 All vibration instruments shall be calibrated within the past (6) months to ensure accurate and reliable instrument performance.

PART 3 - EXECUTION

3.1 SETTLEMENT MONITORING

.1 Each structure or service shall be provided with, at a minimum, three (3) monitors (two (2) at the side of each structure closest to the excavations and one (1) at the side of each structure furthest from the excavations to monitor for potential differential movement.

.2 All elevations shall be monitored relative to a non-settling benchmark (e.g., a bedrock outcrop, a building located outside the influence of the project built on piles or bedrock, or an existing maintenance hole not impacted by construction). These benchmark monument(s) shall clearly be identified in the Contractor's Settlement Monitoring Plan, which shall also reference which structures are monitored relative to which benchmark. Survey reading for settlement monitoring will be completed with a tolerance of +/- 2 mm. Survey control shall be carried out by a third-party OLS-Certified Land Surveyor, not affiliated with the Contractor.

.3 Baseline elevations of each structures' survey monuments shall be established by taking three complete sets of readings in advance of any construction, completed on three separate days. The average of the three readings will be used as the baseline for subsequent readings.

.4 Subsequent readings should be taken weekly during all construction activities, which includes drilling, excavation, backfilling/compacting, demolition and paving, at all existing and new structures.

.5 The Consultant retains the discretion to increase the frequency of readings if measurements in excess of the review limit are recorded.

.6 A final set of readings shall be collected at six (6) months following completion of construction. The Consultant shall receive a copy of all settlement monitoring for their reference immediately after the survey is completed.

.7 The movement limits at all locations shall be as follows:

.1 Review Limit: Total Settlement: 4 mm
.2 Alert Limit: Total Settlement 6 mm.

.8 The Consultant shall be notified immediately if the Review Limit for a structure or service is exceeded.

.9 If the Review Limit is exceeded, survey readings shall be taken hourly, during active work, until three (3) consecutive readings indicate that the movement magnitudes are not increasing (i.e., the movements have stopped or the rate of movement has slowed to a rate that does not indicate the Alert Level will be exceeded during the remaining work duration).

.10 If the Alert Limit is exceeded at any structure, construction shall cease immediately until a plan is developed by the Contractor to proceed safely without causing additional settlement to the building or service.

3.2 VIBRATION MONITORING

.1 No vibration producing construction activities including demolition can begin until the vibration monitoring system is verified to be operating by the Vibration Monitoring Specialist.

.2 The Vibration Monitoring Specialist will furnish, maintain and operate (amplitude and frequency sensitive) vibration monitoring system during any vibration producing activities completed. The system shall be installed and maintained in accordance with manufacturer's recommendations, calibration standards, and specifications. Sufficient monitors will be employed to accurately measure vibrations in the adjacent spaces.

.3 Construction activities shall be controlled to limit the peak particle velocities at all adjacent structures and services such that vibration induced damage will be avoided.

.4 The following table defines the frequency dependent peak vibration limits for all construction activities (activities including piling, excavating, demolition and compacting are particularly vibration-inducive).

Element	Frequency (Hz)	Maximum Peak Particle Velocity, PPV (mm/sec)
Forcemain, Structures and Service installations	≤ 10	5
	10 to 40	5 to 50
	> 40	50
Concrete and Grout < 72 hours from placement	N/A	10

.5 Vibration monitoring points shall be established as required and shall be monitored and maintained on a continuous basis over the entire construction duration.

.6 As a minimum, vibration monitoring shall be carried out, during all construction activities, at every structure and locations of critical equipment within 75 m of active work.

.7 The monitoring plan shall clearly identify all monitoring points and vibration monitoring equipment to be used. The monitoring shall include but not be limited to ground vibration, peak sound pressure level and water over pressure.

.8 All instrumentation shall have been calibrated annually and be capable of measuring and recording

frequencies in three mutually perpendicular directions.

.9 Vibration intensive construction activities (e.g., piling, excavation, compaction, etc.) shall commence at the furthest points of work from the closest structure or service to assess the ground vibration attenuation characteristics and to confirm the anticipated ground vibration levels based on the Contractor's proposal.

.10 If the vibration monitoring demonstrates that construction activities are resulting in vibrations that exceed the aforementioned vibration limits, the Contractor shall be required to stop and immediately adjust their operation including the use of different equipment until the construction vibrations are below the specified vibration limits.

.11 Vibration monitoring data shall be maintained throughout the demolition activities. Where 80% of the prescribed limit is met, the Contractor, Owner and Consultant shall be advised and adjustments should be completed to ensure exceedances do not occur. Should vibration exceedances be identified, then the work shall be adjusted to meet the vibration limits and all parties advised of the proposed adjustments.

.12 Following successful start-up of the vibration monitoring system, the Specialist shall carry out a site visit to assess the observed vibration producing construction activities along with the measured vibrations. The Specialist shall furnish a report identified corrective actions as required. Follow-up visits will be required if exceedances are identified.

3.3 GROUNDWATER LEVEL MONITORING

.1 Groundwater levels shall be monitored during construction. Groundwater levels are being recorded for information purposes only.

.2 The existing monitoring wells installed during the geotechnical investigation should not be decommissioned until after the construction of all underground work in the vicinity is completed. These existing wells may also be used for groundwater monitoring during construction.

.1 The Contractor shall be responsible for maintaining the existing monitoring wells and the Owner or any other party shall not be held responsible for maintenance of the existing monitoring wells.

.3 Three complete sets of baseline readings shall be taken, each seven (7) days apart, prior to commencing excavating activities. The first set of baseline readings should be taken no sooner than seven (7) days after a well is installed (if not previously installed prior to construction).

.4 During construction, readings shall be taken daily for wells that are located within the 125 metres of construction activities, whether dewatering is occurring or not. During periods when the wells are located outside the radius of influence, readings shall be taken at least once every two weeks.

.5 Water levels and raw water quality shall be monitored at a representative sample of private water wells in accordance with the Permit to Take Water. Raw water quality samples shall be tested for select parameters in accordance with O.Reg. 169/03 - Ontario Drinking Water Quality Standards.

.6 The Consultant has the discretion to increase the frequency of readings.

.7 A final set of readings shall be collected one (1) month following completion of construction.

.8 The Consultant shall receive a copy of all groundwater monitoring for their reference immediately after the survey is completed.

END OF SECTION

PART 1 - GENERAL

1.1 GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

.1 Geotechnical and hydrogeological investigations have been carried out by Gemtec Consulting Engineers and Scientists Limited and entitled *"Geotechnical and Hydrogeological Investigation Casselman Main Sewage Pumping Station Upgrades"*, Gemtec Project No. 100117.051, dated January 6, 2024 and are included in attached appendices.

.2 This is hereby offered to the bidder in good faith for general information and guidance. The Owner and the Consultant accept no responsibility for the accuracy of the information within.

.3 The reports provided in this document are for reference only. Responsibility for the review and the statements within remain entirely with its author.

.4 In case of discrepancies between the recommendations contained in this report and requirements of the Contract Documents, the Contract Documents shall govern. Should discrepancies be discovered, advise the Consultant in writing prior to proceeding with the Work.

.5 The Contractor shall not be entitled to additional payment and / or performance time for conditions that are reasonably inferable from subsurface investigation report.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM C478-14. Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
- .2 ASTM D698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)).

.2 Canadian Standards Association (CSA International)
- .1 CAN/CSA-A23.1-09/A23.2-09 (R2014), Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consist of A3001, A3002, A3003, A3004 and A3005).
  - .1 CSA-A3001-13, Cementitious Materials for Use in Concrete.
- .4 CAN/CSA-G30.18-09 (R2019), Carbon Steel Bars for Concrete Reinforcement.

.3 Ontario Provincial Standard Drawings (OPSD)
- .1 OPSD 401.010, Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes.
- .2 OPSD 404 Series, Aluminum Safety Platform.
- .3 OPSD 701 Series, Precast Concrete Maintenance Holes.
- .4 OPSD 704.010, Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
- .5 OPSD 1101.012, Precast Concrete Valve Chamber with Poured-in-Place Thrust Blocks 1800 x 2400 mm, Components.

.4 Ontario Provincial Standard Specifications (OPSS)
- .1 OPSS.MUNI 1010, Material Specifications for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.
- .2 OPSS 1351, Material Specification for Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers.
- .3 OPSS 1850, Material Specification for Frames, Grates, Covers, and Gratings.

1.2 SUBMISSIONS

.1 Provide submittals in accordance with Section 01330 - Submittal Procedures.

.2 Provide shop drawings for all structures, identifying all connection information.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store, and handle materials in accordance with manufacture’s written instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Precast Structures as per OPSS.MUNI 1351 and the following:
  .1 Maintenance holes as per OPSD 701 Series as indicated.
  .2 Drain Chambers per OPSD 1101.012 and MCON Drycast Maintenance Hole 2400 x1800mm Box Chamber or similar equivalent.
  .3 Air Release Chambers per Section 02632.

.2 Joints: made watertight using 20mm butyl mastic in addition to the standard rubber gasket

.3 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164.
  .1 Rungs to be safety pattern (drop step type).

.4 Precast adjusting rings: to ASTM C478M

.5 Frames, gratings, covers as per OPSS.MUNI 1850 to dimensions as indicated and the following requirements:

  .1 Sanitary maintenance holes to OPSD 401.010 Type ‘A’.

.6 Precast concrete adjustment units to OPSD 704.010.

.7 Granular bedding and backfill: to be Granular ‘A’ to Section 02701.

.8 Safety Platform as per OPSD 404 Series.

.9 Waterproofing: self-adhering membrane impermeable to moisture vapour and water (i.e. Henry Bakor Blueskin ® SA or approved equivalent).

.10 Pipe penetration seal: Link-Seal® modular seal or approved equivalent.

.11 Ring clamps: adjustable screw type.

PART 3 - EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer’s written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 02315 – Excavation, Trenching and Backfilling and as indicated.

.2 Obtain approval of the Consultant before installing maintenance holes.

3.3 CONCRETE WORK

.1 Concrete work shall be in accordance with Section 03300, Cast-in-Place Concrete.

.2 Bench manholes as per OPSD 701.021.

3.4 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 See Section 02632 for installation requirements for Air Release Chambers.

.3 Complete units as pipe laying progresses
- .1 Maximum of three units behind point of pipe laying will be allowed.

.4 Dewater excavation to approval of the Consultant and remove soft and foreign material before placing concrete base.

.5 Set precast concrete base on 150mm minimum of granular bedding compacted to 95% Standard Proctor Maximum Dry Density (SPMDD) to ASTM D 698.

.6 Install maintenance hole section as per OPSD 700 series drawings.

.7 All bedding, surround, maintenance hole backfill to be compacted to 98% SPMDD.

.8 Bench maintenance holes to OPSD 701.021 as indicated.

.9 Use a resilient connector for all flexible and rigid pipe connections.

.10 Adjust all structures as per OPSS 408.

.11 Precast Units:
- .1 Make each successive joint watertight with 20mm butyl mastic applied to all joints, in addition to the standard rubber gasket, to the approval of the Consultant.
- .2 Clean surplus joint compounds from interior surface of unit as work progresses.
- .3 Sanitary maintenance holes must have a self-adhesive waterproofing a minimum of 300mm above and below every joint.
- .4 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
- .5 Boot connections must have two ring clamps to tighten the boot to the pipe, to the approval of the Consultant.

.12 For sewers:
- .1 Place stub outlets and bulkheads at elevations and in positions indicated.
- .2 Bench to provide smooth U-shaped channel as per OPSD 701.021.
  - .1 Curve channels smoothly.
  - .2 Slope invert to establish sewer grade.

.13 Compact granular backfill to 98% SPMDD to ASTM D 698.

.14 Place unshrinkable backfill in accordance with Section 02315 – Excavation, Trenching and Backfilling.

.15 Installing units in existing systems:
- .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
- .2 Make joints watertight between new unit and existing pipe.
- .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate breakouts, removals, redirection of flows, blocking unused pipes, or other necessary work.

.16 Existing maintenance hole structures must be cored when new pipes are installed. Sanitary maintenance holes must include a link-seal, adjustable from the inside of the structure.

.17 Set frame and cover to required elevation on no more than three adjustment units.
- .1 Parge and make smooth and watertight.

.18 Clean units of debris and foreign materials.
- .1 Remove fins and sharp projections.
- .2 Prevent debris from entering systems.

.19 Install safety platforms in maintenance holes having a depth of 5m or greater, as indicated.

3.5 ADJUSTING FRAMES AND GRATES

.1 New structures:
- .1 All maintenance holes and catch basins located in the pavement are to have the frame set at base course elevation. These frames are subject to final adjustment immediately prior to surface course installation.

.2 Existing structures:
- .1 Remove existing frames. Contractor is responsible for the excavation, handling, hauling, and disposal costs of all soils excavated as part of the Work.

.3 Sectional Units:
- .1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
- .2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replacing cone section.
  - .1 Follow OPSD 704.010 when amount of raise is less than 600mm.

3.6 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools, and equipment.

3.7 TESTING

.1 All structures to be water leakage tested as per OPSS 407.

.2 All visible signs of leakage are to be repaired regardless of results of leakage test.

3.8 CLOSEOUT

.1 Contractor to provide pipe size, material, and invert information on as-built drawings.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

.1 Provide and install air release chambers.

1.2 REFERENCES

.1 Ontario Provincial Standard Drawings (OPSD 701.010)

.2 Ontario Provincial Standard Specifications (OPSS.MUNI 412)

1.3 SUBMISSIONS

.1 Provide submittals in accordance with Section 01330 - Submittal Procedures.

.2 Provide shop drawings for all structures, identifying all connection information per Section 02631 – Maintenance Holes and Catch Basins.

PART 2 - PRODUCTS

2.1 MAINTENANCE HOLE

.1 1200mm diameter maintenance hole as per OPSD 701.010.

.2 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164-18 (R2023).

.1 Rungs to be safety pattern (drop step type).

.3 Precast adjusting rings: to ASTM C478M

.4 Frames, gratings, covers as per OPSS.MUNI 1850 to dimensions as indicated and the following requirements:

.1 Sanitary maintenance holes to OPSD 401.010 Type ‘A’.

.5 Precast concrete adjustment units to OPSD 704.010.

.6 Granular bedding and backfill: to be Granular ‘A’ to Section 02701.

.7 Waterproofing: self-adhering membrane impermeable to moisture vapour and water (i.e. Henry Bakor Blueskin ® SA or approved equivalent).

.8 Pipe penetration seal: Link-Seal® modular seal or approved equivalent.

.9 Ring clamps: adjustable screw type.

2.2 SERVICE SADDLE

.1 Equal to Robar 1520 with 50mm NPT

2.3 GATE VALVES

.1 Bronze gate valve, non-rising stem, wedge disc equal to Crane No. 438 with threaded ends to ANSI B2.1 for working pressure of 125 psi.

2.4 PIPE

.1 PVC Schedule 80 in accordance with CSA B137.3.

2.5 AIR RELEASE

.1 APCO No. 440 sewage air release valve complete with back flushing hose, and quick disconnect couplings. Provide valving and piping as shown on the detail drawing.

PART 3 - EXECUTION

3.1 MAINTENANCE HOLE

.1 Construct maintenance hole at high points as shown on the Issued For Construction Drawings.

.2 Installation to follow Section 02631 – Maintenance Holes and Catch Basins.

3.2 SERVICE SADDLE

.1 Install service saddle at the 50mm entrance to the forcemain at the top of pipe.

.2 Ream out 50mm hole at the top of forcemain at the 50mm connection on the service saddle.

3.3 AIR RELEASE VALVE ASSEMBLY

.1 Assemble the air release valve and associated piping and valves before connecting to the service saddle.

.2 Secure the air release valve assembly in a vertical orientation and test the assembly with a pressured water connection with a pressure of at least 450 kPa (65 psi).

.3 Ensure that the air release valve functions properly by applying pressure, then draining the water from the air release valve several times.

.4 Eliminate any leakage that may occur in the assembly.

.5 Install assembly into the service saddle.

3.4 INTITAL START UP

.1 When the forcemain is pressurized, witness the operations of the air release valve to ensure it functions properly.

.2 The air exhausted from the air release valve may be toxic and unsafe to ingest; therefore, ensure that safety precautions are observed to avoid injury.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

.1 Provide and install the maintenance hole for injecting alum and the alum feed line in a heat traced conduit.

1.2 REFERENCES

.1 Ontario Provincial Standard Drawings (OPSD 701.010, 701.030)

.2 Ontario Provincial Standard Specifications (OPSS.MUNI 412)

.3 GF+ URECON EN-DS-02E Standard U.I.P. System for below grade piping

.4 Alum Injection Maintenance Hole Detail on page C109 of the Issued For Construction Drawings

1.3 SUBMISSIONS

.1 Provide submittals in accordance with Section 01330 - Submittal Procedures.

.2 Provide shop drawings for the alum injecting structure, identifying all connection information per Section 02631 – Maintenance Holes and Catch Basins.

PART 2 - PRODUCTS

2.1 MAINTENANCE HOLE

.1 1200mm diameter maintenance hole as per OPSD 701.010.

.2 Ladder rungs: to CAN/CSA-G30.18, No. 25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164.

.1 Rungs to be safety pattern (drop step type).

.3 Precast adjusting rings: to ASTM C478M

.4 Frames, gratings, covers as per OPSS.MUNI 1850 to dimensions as indicated and the following requirements:

.1 Sanitary maintenance holes to OPSD 401.010 Type ‘A’.

.5 Precast concrete adjustment units to OPSD 704.010.

.6 Granular bedding and backfill: to be Granular ‘A’ to Section 02701.

.7 Waterproofing: self-adhering membrane impermeable to moisture vapour and water (i.e. Henry Bakor Blueskin ® SA or approved equivalent).

.8 Pipe penetration seal: Link-Seal® modular seal or approved equivalent.

.9 Ring clamps: adjustable screw type.

2.2 ALUM INJECTION TO FORCEMAIN

.1 Service saddle equal to Robar 1520 with 50mm connection with AWWA thread.

.2 Main stop equal to Emco 50mm mains top with AWWA inlet and successor outlet.

2.3 INSULATED CONDUIT

.1 GF+ Urecon Pre-Insulated conduit 200 mm diameter Series 100 – PVC pipe to CSA B137.3 and AWWA C 905 with gaskets installed to joints or similar equivalent. Fittings to CSA B137.2 or CSA B137.3

.2 Insulation to be 63 mm rigid polyurethane as supplied by GF+ Urecon. With a 1.27mm thick polyethylene jacket.

.3 Joints to be made using approved polyurethane half shells and wrap around sleeves or heat shrink sleeves.

2.4 POLYETHYLENE ALUM LINE

.1 50mm diameter polyethylene alum line

2.5 HEAT TRACE CABLE

.1 One circuit of 13Watt/meter Constant Watt Thermocable® to be installed within 200mm PVC pipe.

PART 3 - EXECUTION

3.1 MAINTENANCE HOLE

.1 Construct alum maintenance hole as shown on the Contract Drawings. Provide opening for 200mm conduit.
.2 Installation to follow Section 02631 – Manholes and Catch Basins.

3.2 CONNECTING NEW ALUM INJECTION LOCATION

.1 Construct the new GF+ Urecon 200mm insulated duct to connect with the alum injection manhole.
.2 Provide and install sufficient length of heat tracing cable for length of alum line duct.
.3 Provide and install a new termination kit as recommended by the supplier.
.4 Install 50mm alum pipe from the alum building to the manhole.
.5 Install saddle with main stop at new 400 mm forcemain inside the new manhole
.6 Connect 50 mm alum pipe at mainstop and pressure test.
.7 Activate electrical heat trace cable and check that it delivers its rated capacity.
.8 Contractor to install conduit into manhole at new 400mm forcemain. Coordinate construction of conduit and installation of heat trace and alum pipe.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 OPSS.MUNI 1010 Material Specialization for Aggregates – Base, Subbase, Select Subgrade and Backfill Material.

.2 OPSS.MUNI 1004 Material Specialization for Aggregates – Miscellaneous.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Sand to be fine aggregates satisfying requirements of applicable section to be one, or blend of following:
- .1 Natural sand.
- .2 Manufactured sand.
- .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.2 Granular 'A':
- .1 As per OPSS.MUNI 1010 modified as follows:
  - .1 Crushed, quarried bedrock only.

.3 Granular 'B':
- .1 As per OPSS.MUNI 1010 modified as follows:
  - .1 Granular B Type II only. Type I not to be used.

.4 Engineered Fill:
- .1 To be either Granular ‘A’ or Granular ‘B’ Type II as defined above, unless noted otherwise.

2.2 SOURCE QUALITY CONTROL

.1 Inform Consultant of proposed source of aggregates at least two (2) weeks prior to commencing production or hauling to site.

.2 Advise Consultant two (2) weeks in advance of proposed change of material source.

.3 If, in the opinion of the Consultant, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

2.3 STOCKPILING AND HANDLING

.1 At all times, aggregates shall be handled and transported in a manner and with equipment that avoids segregation of the material, excess loss of fines, and contamination by any deleterious

material.

.2 Stockpile sites shall be level, well drained, free of all foreign materials, and of adequate bearing capacity to support the mass of the materials to be placed thereon. Stockpiles shall be either far enough apart or separated by substantial dividers to prevent intermingling.

.3 For all aggregates, except when stockpiled on Portland cement concrete or asphaltic concrete foundations or on an uncontaminated durable surface, a compacted granular pad of material with a maximum particle size no larger than that of the material being stockpiled and not less than 0.3 m in depth shall be provided to prevent contamination of the piled material. This granular pad shall not be incorporated into the Work.

.1 For sand stockpiles, the foundation shall be as specified above for aggregates or the material may be placed on the ground provided that the bottom 0.3 m of the pile is not incorporated into the Work.

PART 3 - EXECUTION

3.1 NOT APPLICABLE

.1 Not Applicable.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section specifies requirements for supplying and installing gravity piping to lines, grades indicated on drawings or as directed by Consultant.

1.2 SOURCE QUALITY CONTROL

.1 Provide certified copies of pipe tests, shop drawings and other pertinent information.

.2 Have all pipes inspected by accredited inspection company before being delivered to job and stamped with their approval mark.

.3 Consultant may reject materials pending result of tests.

.4 Cost of all tests and inspections to be borne by Contractor.

1.3 AS-CONSTRUCTED DRAWINGS

.1 Provide data necessary to produce 'as-constructed' drawings, including details of pipe material, invert elevations at maintenance holes and connections, location of tees, bends, clean-outs, maintenance holes, saddles, laterals and caps.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Maintain existing flows during construction.

.3 Submit schedule of expected interruptions for approval by Consultant and adhere to interruption schedule as approved.

PART 2 - PRODUCTS

2.1 SANITARY SEWER (PVC PIPE)

.1 All pipe and fittings are to carry CSA certification to the appropriate CSA standard sewer grade.

.2 All pipe to be type PSM polyvinyl chloride (PVC) pipe with elastomeric gasket as per OPSS 1841 and CSA 182.2 or 182.7.

.3 Profile pipe such as those meeting CSA 182.4 are not to be used for sanitary sewers.

.4 Pipe to be green in colour.

.5 Sanitary mains to be DR 35 pipe, building laterals to be DR 28 pipe.

2.2 CEMENT MORTAR

.1 Portland cement to CSA A5-98 normal symbol 10.

.2 Mortar to be one part by volume of cement to two parts clean, sharp sand mixed dry. Add only sufficient amount of water after mixing to give optimum consistency for placement. Do not use additives.

2.3 NON-SHRINK GROUT

.1 Use proprietary products: In-Pakt by Grace Construction Products; V-1 Grout by W.R. Meadows; M-Bed by Sternson; or approved alternative.

2.4 POURED CONCRETE

.1 Comply with requirements of CSA A23.1 and A23.2.
  .1 To requirements of Section 03300 – Cast-in-Place Concrete.

2.5 INSULATION

.1 Overflow sewer pipe to be insulated with a polyethylene jacket surrounding the circumference of pipe. Use of 600mm Urecon insulated pipe or approved equivalent.

2.6 HEAT TRACE CABLE

.1 One circuit of 13Watt/meter Constant Watt Thermocable® to be installed around 600mm PVC pipe. See Section 16857 – Heating Cables for further details.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Clean pipes and fittings of accumulated debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 TRENCHING

.1 Do trenching and backfill work to Section 02315 – Excavation, Trenching and Backfilling.

.2 Trench line and depth requires Consultant's approval prior to placing bedding material or pipe.

.3 Do not backfill trenches until pipe grade and alignment have been checked and accepted by Consultant.

3.3 GRANULAR BEDDING

.1 Place and compact granular bedding materials to details indicated or specified.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe exterior. Do not use blocks in bedding pipe.

.3 Shape transverse depressions as required to receive bell.

.4 Upon completion of pipe laying, place bedding simultaneously on each side of pipe to prevent displacement. Compact in layers as required.

3.4 INSTALLATION

.1 Lay and joint pipes in accordance with OPSS.MUNI 410 and manufacturer's recommendations.

.2 Take up and re-lay in correct position any pipe laid with variations from required grade exceeding +20 mm.

.3 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.4 Do not allow any water to flow through pipe during construction, except as may be permitted by Consultant.

.5 Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.6 Pipe Jointing:

- .1 Install gaskets in accordance with manufacturer's recommendations.
- .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .3 Align pipes carefully before joining.
- .4 Maintain pipe joints free from mud, silt, gravel or other foreign material.
- .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
- .6 Complete each joint before laying next length of pipe.
- .7 Apply sufficient pressure in making joints to ensure that the joint is complete as outlined in the manufacturer's recommendations.
- .8 Minimize joint deflection after joint has been made to avoid joint damage.
- .9 At rigid structures, install a pipe joint not more than 500 mm from side of structure.

.7 Block pipes when any stoppage of work occurs to prevent "creep" during down time.

.8 Cut pipes as required for special inserts, fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe.

.9 Make watertight connections to maintenance holes and with non-shrink grout or as detailed.

.10 Install heat tracing cable along length of sewer overflow pipe as shown on drawing C101 of the Issued for Construction Drawings. Install per Section 16857 – Heating Cables

3.5 FLUSHING AND CLEANING

.1 Clean completed sewers to satisfaction of Consultant.

3.6 FIELD TESTING SEWERS

.1 Test heat tracing cable for desired capacity, see Section 16857 – Heating Cables for further

details.

.2 When directed by Consultant, or if deflections are identified in the CCTV inspection, draw a solid plug, in accordance with OPSS.MUNI 410, through all PVC sewers to ensure that pipe is free of obstruction, and not excessively deformed.

.3 Air Test PVC pipe as per OPSS.MUNI 410.

.4 Perform tests in presence of Consultant. Notify Consultant 24 hours in advance of proposed tests.

.5 Repair and retest sewer line as required, until test results are within limits specified.

.6 Repair visible leaks regardless of test results.

3.7 CLEANUP

.1 Remove all equipment and excess materials and clean up all work areas continuously as construction progresses.

.2 Before final inspection, clean and flush out all sewers to remove all foreign material.

3.8 CCTV INSPECTION

.1 Gravity Sewers shall have a closed-circuit television (CCTV) inspection according to OPSS.MUNI 409 with the following modifications:

.1 409.06.03 Survey Equipment shall be removed and replaced by:

.1 The surveying equipment shall be capable of surveying a length of pipeline up to:

.1 350 m where entry to the pipeline may be obtained at each end of the pipeline;

.2 30 m where rodding is used; or

.3 300 m where a self-propelled unit is used when entry is at only one end of the pipeline.

.4 200 m when being towed.

Work shall not commence in a work shift until the Consultant is satisfied that all items of the survey equipment have been provided and are in full working order.

Each survey unit shall contain a means of transporting the CCTV camera in a stable condition through the pipeline.

The CCTV camera must be a self-propelled unit unless otherwise approved in writing by the Consultant.

Each unit shall carry sufficient number of guides and rollers such that, when surveying, all cables are supported away from pipe and maintenance hole edges. All CCTV cables and lines used to measure the camera's location within the pipeline shall be maintained in a taut manner and set at right angles, where possible, to run through or over the measuring equipment.

.2 409.07.01 Pipeline Cleaning shall be removed and replaced by:

Sewers shall be clean to the satisfaction of the Consultant. If the camera inspection reveals that further cleaning is required, at the sole discretion of the Consultant, the sewer shall be cleaned and re-inspected at no additional cost to the Owner.

.3 409.07.04.01 General shall be removed and replaced by:

Paragraph 4 on page 7 shall be removed and replaced by:

A fixed camera may be used for pipelines less than 175 mm in diameter. For pipelines equal to or greater than 175 mm, a pan and tilt camera shall be used. Each camera must have an accepted sample submissions report prior to being used for inspection work. The camera lens shall be kept clean at all times during the inspection.

Paragraph 8 on page 6 shall have the following item added to the list of minimum required information:

i) First and last name of the NASSCO PACP certified CCTV operator.

Paragraph 1 on page 8 shall have the following information added:

…..continually displayed in the middle of the bottom portion of the screen and the start maintenance hole ID number will be in the top left corner of the screen and the end maintenance hole ID number will be in the top right corner of the screen.

The standard referenced in Paragraph 3 page 8 shall be NASSCO Canadian Edition of the Pipeline and Assessment Certification Program (PACP).

.4 409.07.05.01 Paragraph 1 including “a)”, “b)” and “c)” shall be removed and replaced by:

“Reports shall be submitted to the Contract Administrator in the following formats, within 10 working days of the completion of the field work, with the noted number of copies:
One (1) copy of each pipeline report in an electronic format.
One (1) copy of the sewer inspection database (.MDB file), the database shall include NASSCO PACP coding for all completed CCTV inspection work and properly link all file names and file extensions to the video (.mpg) and image (.jpg) files.
One (1) copy of the video survey in an electronic format with each sewer run identified and in its own mpeg format. The name of the video survey file shall be equivalent to the Upstream maintenance hole ID + the Pipe ID + Downstream maintenance hole + date (i.e., “8594-010-5514-_8594-020_20180101.mpg”).

REPORT FORMAT	NO. OF COPIES	REQUIRED
Electronic Format Report	1 per pipeline	Within 10 days of completion of inspection
Digital Data Files (MDB file)	1 per street	Within 10 days of completion of inspection
Electronic copy of the pipeline Videos	1 per pipeline	Within 10 days of completion of inspection. The files will be in a *.mpg format

3.9 MARKING OF MAINS AND SERVICES

.1 Sewer mains shall be marked with 50 mm wide detectable metallic tape green in colour imprinted with “Buried Sewer Line Below”. The tape shall be SETON PRODUCT No. 48300 or equivalent.

.2 The marker tape shall be placed 300mm to 450 mm above the main or service.

3.10 REMOVAL AND/OR ABANDONING EXISTING SEWERS

.1 Removal or abandonment of existing sewer pipes and/or culverts shall be in accordance with OPSS.MUNI 510.

3.11 REMOVAL/ABANDONING OF EXISTING STRUCTURES

.1 In the context of this section the term “structure” shall apply to maintenance holes and inlet structures including their related appurtenances.

.2 Removal or abandonment of existing structures shall be in accordance with OPSS.MUNI 510.

.3 At the direction of the Consultant, the Contractor shall demolish/remove designated maintenance hole structures to a minimum depth of one (1) metre below finished grade. The remaining structure is to be filled with concrete and the resulting excavation backfilled and compacted with Granular “A”. Alternatively, at the discretion of the contractor the structure shall be removed in its entirety. Those appurtenances that are deemed salvageable in the opinion of the Consultant shall be set aside for removal by others.

END OF SECTION

PART 1 - GENERAL

1.1 NOT APPLICABLE:

.1 Not applicable.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular base: Granular 'A' per Section 02701 - Aggregates: General.

PART 3 - EXECUTION

3.1 PLACING

.1 Place granular base after sub-base surface is inspected and approved by Consultant.

.2 Construct granular base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow and ice.

.5 Begin spreading base material on crown line or on high side of one-way slope.

.6 Place material using methods which do not lead to segregation or degradation of aggregate.

.7 Place material to full width in uniform layers not exceeding a total 150 mm compacted thickness. Consultant may authorize thicker lifts (layers) if specified compaction can be achieved.

.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.9 Remove and replace that portion of layer in which material becomes segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density not less than 100% Standard Proctor Maximum Dry Density (SPMDD) in accordance with ASTM D 698 and ASTM D 2922.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.4 Apply water as necessary during compacting to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers

approved in writing by Consultant.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

.1 Contractor to ensure minimum depth of granular is provided as indicated on the Contract Drawings. Finished base surface to be within plus or minus 10 mm of established grade and cross-section but not uniformly high or low, to match the existing roadway.

3.4 PROTECTION

.1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 NOT APPLICABLE

.1 Not applicable.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular sub-base: Granular 'B', Type II as per Section 02701 – Aggregates: General.

PART 3 - EXECUTION

3.1 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by the Consultant.

.2 Construct granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Begin spreading sub-base material on crown line or high side of one-way slope.

.6 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Consultant may authorize thicker lifts (layers) if specified compaction can be achieved.

.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.9 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to density of not less than 100% Standard Proctor Maximum Dry Density (SPMDD) in accordance with ASTM D 698 and ASTM D 2922.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers

approved in writing by Consultant.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

.1 Contractor to ensure minimum depth of granular is provided as indicated on the Contract Drawings. Finished sub-base to be within 10 mm of elevation to match the existing roadway but not uniformly high or low.

3.4 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Ontario Provincial Standard Specifications

OPSS.MUNI 412 – Forcemain Installation in Open Cut

OPSS.MUNI 441 – Watermain Installation in Open Cut

OPSS.MUNI 442 – Corrosion Protection of Watermains

1.2 DESCRIPTION

.1 Supply and install forcemains and valves in open cut where specified on the Contract Drawings.

1.3 SITE CONDITIONS AND EXCAVATION PLAN

.1 Engage services of a Professional Engineer, licensed in Province of Ontario, with experience and expertise in Geotechnical engineering to design an excavation plan. Include in the plan the required excavation slope angle or shoring/sheet piling design, if required. Designer to check and seal design calculations and drawings of excavation plan.

.2 Refer to Section 02315 - Excavation, Trenching and Backfilling.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 High Density Polyethylene (HDPE) pressure pipe and fittings to OPSS.MUNI 1842, CSA B137, AWWA C901 and AWWA C906.
  .1 DR: 26
  .2 Pressure Class: 65 PSI
  .3 Joints to ANSI/AWWA C207, thermal butt fusions or electrofusion or flanged with steel aluminum backing flanges
  .4 Polyethylene fittings: to CSA B137, for sizes 4” or less

.2 Polyvinyl chloride (PVC) plastic pipe and fittings to CSA B137.
  .1 Pressure rating: 1,140 kPA at 23 ˚C (165 psi at 73 ˚F).
  .2 Gasket on bell end.
  .3 Pipe joints: bell and spigot with rubber gaskets to CSA B137, with transition gaskets to pipe manufacturers specifications.
  .4 Rubber gaskets: to ASTM D 3139. Gaskets for mechanical joints to be duck-tipped transition gaskets for PVC.

2.2 GATE VALVES

.1 Gate valves shall be resilient wedge gate valves that meet or exceed AWWA C509. The gate valves shall be certified to ANSI/NSF 61. Valves shall open clockwise.

.2 Gate valves shall be ductile iron body, with non-rising stems and a 51 mm x 51 mm operating nut positioned for vertical operation. The stem seal shall be of standard O-ring type. All valves shall be supplied with a two-part fusion bonded epoxy coating, factory applied to both the exterior and interior surfaces of the valve per AWWA C-550.

.3 The maximum working pressure shall be 1725 kPa.

.4 Nuts and bolts for gate valve bodies/bonnets and gland rings to be type 316 stainless steel.

2.3 DUCTILE IRON PIPE RESTRAINT

.1 Mechanical restraint for standardised mechanical joints shall be incorporated in the design of the follower gland and shall impart wedging action against the pipe, increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of ductile-iron conforming to the requirements of ASTM A 536, Grade 65-45-12. Wedging mechanisms shall be manufactured of Ductile-iron to hardness of 370 BHN minimum. Dimensions of the gland shall be such that it can be used with the standardised mechanical joint bell and tee head bolts conforming to the requirements of ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest version. Twist off nuts shall be incorporated in the design of the wedge activation screws to ensure proper torque during installation.

.2 The mechanical joint restraining device shall have a working pressure of 1035 kPa with a safety factor of 2.1 against separation when tested in the dead-end situation.

.3 The Mechanical joint restraining device shall be Uni-Flange series 1400 or approved equal.

2.4 PIPE BEDDING AND SURROUND MATERIALS

.1 Refer to Section 02315 – Excavation, Trenching and Backfilling, and Contract Drawings.

2.5 BACKFILL MATERIAL

.1 Compacted excavated material in conformance with Section 02315 – Excavation, Trenching and Backfilling.

2.6 CONCRETE

.1 Refer to Section 03300 – Cast-in-Place Concrete.

2.7 GROUT

.1 Refer to Section 03300 – Cast-in-Place Concrete.

2.8 CLAY SEAL MATERIAL

.1 Clay seals shall be in accordance with OPSS.MUNI 1205.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Pipes and fittings are to be clean and dry. Inspect materials for defects. Remove any defective material from the Site.

.2 Prior to installation, obtain the Consultant's approval of the pipes and fittings.

3.2 INSTALLATION OF PIPE

.1 Trenching: do trenching in accordance with Section 02315 – Excavation, Trenching and Backfilling.

.2 Granular Bedding
- .1 Place granular bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 98% Standard Proctor Density.

.3 Installation:
- .1 Forcemain pipes and fittings to be installed as per OPSS.MUNI 412.
- .2 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
- .3 Join pipes in accordance with manufacturer's recommendations.
- .4 Bevel or taper ends of pipe to match fittings in accordance with manufacturer's recommendations.
- .5 Handle pipe by methods recommended by pipe manufacturer and approved by Consultant. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .6 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .7 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.
- .8 Do not exceed 50% of the permissible deflection at joints recommended by pipe manufacturer.
- .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid

to prevent entry of foreign materials.

.10 Position and join pipes with equipment and methods approved by Consultant.

.11 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.12 Align pipes carefully before jointing.

.13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.14 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.15 Complete each joint before laying next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.18 Joints shall be prevented from opening after the pipe has been laid.

.19 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Consultant.

.20 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.21 Do not lay down pipe in water. Keep trenches dry.

.22 Do not lay pipe on frozen bedding.

.23 Install tracer wire as detailed.

.24 Backfill remainder of trench as per Section 02315 – Excavation, Trenching and Backfilling.

.4 Pipe Surround:

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after the Consultant has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 150 mm compacted thickness as indicated.

.4 Compact each layer from pipe invert to mid height of pipe to at least 98% Standard Proctor Density.

.5 Compact each layer from mid height of pipe to underside of backfill to at least 98% Standard Proctor Density.

.6 When field test results are acceptable to Consultant, backfill pipe

.5 Backfill:

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in accordance with Section 02315.

.6 Insulation:

.1 Unless indicated on drawings, insulation shall only be placed upon approval of the Consultant, in accordance with OPSD 1109.030.

.2 Place 50mm rigid polystyrene insulation for every 0.30m reduction in required cover.

3.3 HYDROSTATIC AND LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Consultant at least 24 hours in advance of all proposed tests. Perform tests in presence of Consultant.

.3 Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Consultant.

.5 Leakage testing is to be scheduled to be completed between 8:00 a.m. and 4:00 p.m. local time.

.6 Hydrostatic and Leakage Testing Procedure:
- .1 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.
- .2 Expel air from the forcemain by slowly filling the main with water.
- .3 Apply a hydrostatic test pressure of 450KPa (65 Psi) (1.5 times the working pressure for the piping). Leakage test pressure to be equivalent to the design working pressure.
- .4 Apply pressure for 1 hour for the pressure test and 2 hours for the leakage test.
- .5 Remove defective joints, pipe and fittings and replace with new sound material.
- .6 Define leakage as the amount of water supplied from the water storage tank or meter in order to maintain the test pressure for 2 hours.
- .7 Do not exceed the allowable leakage amount (L) as defined in ANSI/AWWA C605-21.
- .8 Locate and repair defects if leakage is greater than the amount specified.
- .9 Repeat the tests until leakage is within the specified allowance for the full length of the forcemain.

3.4 CATHODIC PROTECTION

.1 Valves and metallic fittings shall be protected with 7.7 kg magnesium anodes.

3.5 SURVEYING OF PIPE JOINTS

.1 Contractor shall complete a survey shot, consisting of coordinates and elevation, of all pipe and fitting joints prior to backfilling:
- .1 For pipes installed in open cut, survey shot shall be taken from the crown of the pipe joint.
- .2 For pipes or fittings installed in the vertical, the vendor shall survey the most northern point of the pipe joint.

.2 Contractor shall maintain records of survey shots in a format acceptable to the Consultant. The shots shall be numbered and correspond with the shop drawings and contract drawings.

.3 The Contractor shall submit survey records monthly for the Consultant’s review. This review does not relieve the Contractor of their responsibility for the proper installation of the work. A complete set of survey records shall be re-submitted to the Consultant at the completion of the forcemain installation works.

3.6 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Compact backfill to at least 98% Standard Proctor Density.

3.7 SURFACE RESTORATION

.1 After installing and backfilling over forcemains, restore the surface to match original condition as directed by Consultant. Contractor to restore impacted trench limits to match existing conditions.

3.8 TRACER WIRE

.1 Tracer wire shall be installed securely on the proposed forcemains.

.2 Tracer wire posts shall be Rhino Triview tracer PED with “Sanitary” markings, or approved equivalent. Installation shall be as per manufacturer’s requirements.

.3 Trace wire shall be RW90XLPE wire, rated at minus 40˚C, coated 7 strand, 10 gauge.

.4 If required, splices and other wire to wire connections shall be made by using Dryconn waterproof connectors or approved equivalent.

.5 The wire shall be installed in such a manner as to be able to properly trace all pipes without loss or deterioration of signal, or without the transmitted signal migrating off the tracer wire.

.6 Tracer wire conductivity testing is to be conducted by a qualified third-party company and witnessed by the Consultant.

.7 Results of tracer wire conductivity testing are to be noted and shall be provided to the Consultant.

.8 A continuity signal shall be applied to the tracer wire and the signal confirmed over the length of all tracer wire installed. The signal shall be detectable for a distance between terminal posts. At no time shall there be a break in the continuity of the tracer wire.

.9 In the event that the conductivity tests fail, the Contractor shall be responsible to repair or reinstall all required tracer wire at their own expense.

3.9 THRUST BLOCKS AND RESTRAINED JOINTS

.1 For thrust blocks: complete concrete work in accordance with Section 03300 - Cast-in-Place Concrete.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, horizontal bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Consultant.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

.5 Restrain all horizontal and vertical joints as outlined on the Contract Drawings using approved restraining rings.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM C 88-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C 117-17, Standard Test Method for Material Finer Than 75 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .3 ASTM C 123/123M-14, Standard Test Method for Lightweight Particles in Aggregate.
- .4 ASTM C 127-15, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
- .5 ASTM C 128-15, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate.
- .6 ASTM C 131/C 131M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .7 ASTM C 136/C 136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .8 ASTM D 5581-07A (2021)e1, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 Inch Diameter Specimen).
- .9 ASTM D 2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .10 ASTM D 3203/D 3203M-11, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- .11 ASTM D 4791-10, Standard Test Method for Flat Particles, Elongated Particles or Flat and Elongated Particles in Coarse Aggregate.

.3 Asphalt Institute (AI).
- .1 Asphalt Institute MS-2-2015 Seventh Edition, Asphalt Mix Design Methods.

.4 Ontario Provincial Standard
- .1 OPSS.MUNI 310 Construction Specification for Hot Mix Asphalt
- .2 OPSS.MUNI 1150 Material Specification for Hot Mix Asphalt

1.2 PRODUCT DATA

.1 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175°C at least 2 weeks prior to commencing work.

.2 Submit manufacturer's test data and certification that asphalt cement meets requirements of this section.

.3 Submit manufacturer's test data and certification that hydrated lime meets requirements of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 HL3, HL3F and HL8 asphalt is to conform to OPSS 1150.

.2 Tack coat shall consist of SS-1 or SS-1HH emulsified asphalt diluted with an equal volume of water. The undiluted material shall be according to OPSS 1103

PART 3 - EXECUTION

3.1 PLACING AND COMPACTING

.1 Placing and compacting of hot mixed, hot laid asphaltic cement is to be in accordance with OPSS.MUNI 310.

3.2 TRENCH CUT REINSTATEMENT

.1 All trench cuts in asphalt are to be repaired with asphalt to match existing asphalt structure. Trench cuts are to include a stepped key with the existing asphalt. Detail of reinstatement can be found on the Contract Drawings. Contractor to submit asphalt mix for approval prior to undertaking work.

3.3 ASPHALT PAVING SCHEDULING

.1 After all underground work has been completed and heavy construction vehicle traffic has been reduced to a minimum, all existing asphalt surfaces identified in the Drawings for removal and/or impacted by construction activities, shall be removed to granular base, including areas patched during construction activities.

.2 Granular base is to be shaped to suit final pavement elevations.

.3 Binder course is to be placed as per OPSS.MUNI 310.

.4 All catch basins, catch basin maintenance holes, and maintenance holes within the area of asphalt paving are to have their frames and grates set for binder course elevation.

.5 After the acceptance of the results of the CCTV inspection of the storm and sanitary sewer systems, all catch basins and catch basin maintenance holes will have their frame and grates set to surface course elevations just prior to surface course paving. Refer to Section 02631 - Maintenance Holes and Catch Basins.

.6 Maintenance holes may be adjusted as per Section 02631 – Maintenance Holes and Catch Basins to match the surface course elevation. Metal adjustment rings are not acceptable.

.7 Surface course asphalt is to be placed as per OPSS 310.

.8 Contractor is to maintain and be responsible for the condition of the asphalt paving until final acceptance by the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS):
- .1 OPSS 710.MUNI, Construction Specification for Pavement Markings.
- .2 OPSS 1712.MUNI, Material Specification for Organic Solvent Based Traffic Paint.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint:
- .1 To OPSS.MUNI 1712.
- .2 Colour: to OPSS.MUNI 1712.

PART 3 - EXECUTION

3.1 EQUIPMENT REQUIREMENTS

.1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

3.2 CONDITION OF SURFACES

.1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.3 APPLICATION

.1 Perform work as per OPSS.MUNI 710.

.2 Contractor to apply pavement markings to any area where pavement markings were removed from works. Pavement Markings to be reinstated to match existing conditions.

.3 Unless otherwise approved by Consultant, apply paint only when air temperature is above 5°C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.

.4 Apply traffic paint evenly at rate of 3 m²/L.

.5 Do not thin paint unless approved by Consultant.

.6 Paint lines to be of uniform colour and density with sharp edges.

.7 Thoroughly clean distributor tank before refilling with paint of different colour.

.8 Replace all partially or fully removed pavement markings as per existing locations and dimensions.

3.4 TOLERANCE

.1 Paint markings to be within plus or minus 12 mm of dimensions indicated.

3.5 PROTECTION OF COMPLETED WORK

.1 Protect pavement markings until dry.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED SECTIONS

.1 Section 01330 – Submittal Procedures.

.2 Section 02311 – Site Grading.

.3 Section 03300 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
- .1 ASTM A 53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A 90/A90M-13, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- .3 A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-138.1-2019, Fabric for Chain Link Fence.
- .2 CAN/CGSB-138.2-2019, Steel Framework for Chain Link Fence.
- .3 CAN/CGSB-138.3-2019, Installation of Chain Link Fence.
- .4 CAN/CGSB-138.4-2019, Gates for Chain Link Fence.
- .5 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA)
- .1 CSA-A23.1/A23.2-09(R2014), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CAN/CSA-A3000-13, Cementitious Materials Compendium.

.4 Ontario Provincial Standard Drawings (OPSD)
- .1 OPSD 972.102 (Fence, Chain-Link, Component – Gate)
- .2 OPSD 972.130 (Fence, Chain-Link, Installation – Roadway)
- .3 OPSD 972.132 (Fence, Chain-Link, Details and Table)

.5 Ontario Provincial Standard Specifications (OPSS)
- .1 OPSS.MUNI 772 (Chain Link Fence).
- .2 OPSS.MUNI 1541 (Chain Link Fence Components.)

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01330 – Submittal Procedures.

.2 Drawings to indicate: corner posts, rails, cantilevered gate, gates, wiring, support structures, foundation, roller assemblies, frames and accessories, fasteners, fabric, line posts, caps.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fence and Gate materials to be provided as per OPSS.MUNI 1541.

2.2 CHAIN LINK FENCE

.1 Tubular concrete forms, round, spirally wound laminated fibre forms internally treated with release material.

.2 Concrete mixes and materials: in accordance with Section 03300 - Cast-in-Place Concrete.

.3 Chain-link fence fabric: to CAN/CGSB-138.1.
- .1 Type 1, Class A, heavy style x 9 gauge.
- .2 Height of fabric: 1.8 m.
- .3 Acceptable material: hot dipped galvanized after weaving.

.4 Posts, braces, and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.

.5 Bottom tension wire: to CAN/CGSB-138.1, Table 2, single strand, galvanized steel wire, 5 mm diameter.

.6 Tie wire fasteners: to CAN/CGSB-138.1, Table 2 steel wire single strand.
- .1 Acceptable material: galvanized steel wires.

.7 Tension bar: to ASTM A 653/A653M, 5 x 20 mm minimum galvanized steel.

.8 Fittings and hardware: to CAN/CGSB-138.2, cast aluminum alloy, galvanized steel malleable or ductile cast iron.

.9 Tension bar bands: 5 x 20 mm minimum galvanized steel.

.10 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.

.11 Overhang tops to provide waterproof fit, to hold top rails.

.12 Turnbuckles to be drop forged.

.13 Organic zinc rich coating: to CAN/CGSB-1.181.

.14 Grounding rod: 16 mm diameter copper well rod, 3 m long.

2.3 GATE

.1 Gate details:
- .1 Type: Double swing gate, per OPSD 972.102 and CAN/CGSB 138.4
- .2 Height: 1.8 m.

.3 Dimensions: dimensions as shown on drawings to provide 6.0 m clear openings.
.4 Frame: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.
.5 Posts and Caps: as per manufacturer's specifications.
.6 Finish: galvanized.
.7 Fasteners/Fittings: galvanized or stainless steel.
.8 Fabric: Type 1, Class A, heavy style x 9 gauge. Fabric to match connecting fence fabric.

.2 Fabricate gate as indicated with electrically welded joints and galvanized after welding.

.3 Fasten fence fabric to gate with a twisted salvage at top.

.4 Furnish swing person gate with galvanized malleable iron hinges, latch, and latch catch with provision for padlock, which can be attached and operated from either side of the gate.

2.4 FINISHES

.1 Galvanizing:
.1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.
.2 For pipe: 550 g/m² minimum to ASTM A 90.
.3 For other fittings: to CAN/CSA-G164.

PART 3 - EXECUTION

3.1 GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.

3.2 ERECTION OF FENCE

.1 Install fence as per OPSD 972.130.

.2 Erect fence along lines as indicated by Consultant to CAN/CGSB-138.3. Location shown on page C104 of the Issued for Construction Drawings.

.3 Auger post holes to manufacturer's dimensions by methods approved by Consultant. Set fibre forms.

.4 Space line posts 3 m apart, measured parallel to ground surface.

.5 Space straining posts at equal intervals not exceeding 30 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.

.6 Install additional straining posts at sharp changes in grade and where directed by Consultant.

.7 Install corner post where change in alignment exceeds 10°.

.8 Install end posts at end of fence and at buildings. Install gate posts on both sides of gate openings.

.9 Place concrete in post holes, then embed posts into concrete to depths indicated. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.10 Do not install fence fabric until concrete has cured minimum of 5 days.

.11 Install brace between end posts and nearest line post, placed in center of panel and parallel to ground surface at inclination as indicated. Install braces on both sides of corner and straining posts in similar manner.

.12 Install overhang tops and caps.

.13 Install top rail between posts, fasten securely to posts, and secure waterproof caps and overhang tops.

.14 Install bottom tension wire, stretch tightly, and fasten securely to end, corner, gate, and straining posts with turnbuckles and tension bar bands.

.15 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Knuckled selvedge at bottom. Twisted selvedge at top.

.16 Secure fabric to top rails, line posts, and bottom tension wire with tie wires at 450 mm intervals. Give tie wires minimum two twists.

.17 Grade surrounding grade smooth.

.18 Install grounding rods.

3.3 INSTALLATION OF GATES

.1 Install gates in locations as indicated on page C104 of the Issued for Construction Drawings.

.2 Level ground between gate posts and set gate bottom approximately 100 mm above ground surface.

.3 Install gate stops where indicated.

3.4 TOUCH-UP

.1 Clean damaged surfaces with wire brush, removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas, in accordance with manufacturer’s instructions. Pre-treat damaged surfaces according to manufacturer’s instructions for zinc-rich paint.

3.5 CLEANING

.1 Clean and trim areas disturbed by operations. Dispose of surplus material, and restore disturbed areas to original condition or better, or as directed by the Contract Drawings and Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 SOURCE QUALITY CONTROL

.1 Inspection and testing of topsoil will be carried out by an independent testing laboratory. Owner will pay for costs of tests, as required.

.2 Test topsoil from source for clay, sand and silt, N, P, K, Mg, soluble salt content, pH value, growth inhibitors, soil sterilants, organic matter and conductivity.

.1 Submit 0.5 kg a sample of topsoil to a testing laboratory and indicate present use, intended use, type of subsoil and quality of drainage. Prepare and ship the sample in accordance with provincial regulations and testing laboratory requirements.

.3 Determine required limestone treatment to bring pH value of soil between a range of 6.0 to 7.5 level.

1.2 SCHEDULING OF FINISH WORK

.1 Schedule the placing of the topsoil and grading to permit sodding and seeding within seven (7) calendar days.

1.3 DEFINITIONS

.1 Compost: should be a mixture of soil and decomposing organic matter, for use as a fertilizer, mulch, or soil conditioner. Compost should be processed organic matter, containing 40% or more organic matter. The product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (a C:N ratio below 25 or 50) and contain no toxic or growth inhibiting contaminates. Composed bio-solids must meet the requirements of the Guidelines for Compost Quality, Category (A) (B) produced by the Canadian Council of the Ministers of the Environment (CCME), Jan. 2005.

.2 Friable: Soil which is easily crumbled through fingers when held by hand.

PART 2 - MATERIALS

2.1 TOPSOIL

.1 All topsoil supplied by the Contractor will be fertile, friable, natural sandy loam containing not less than 4% of organic matter for sandy loams with an acidity value ranging from pH 6.0 to pH 7.5 and capable of sustaining vigorous plant growth. It will be free of stems or roots, stones and clods more than 50 mm diameter or other extraneous matter. Screening of topsoil will be required if designated by the Consultant. Topsoil shall not be supplied in a frozen state.

.2 Topsoil to be imported:

.1 Friable, neither heavy clay nor very light sandy nature consisting of 45% sand, 35% silt, 20% clay and pH value of 6.0 to 7.5. Free from subsoil, roots, vegetation, debris, toxic materials, stones.

.2 Organic Matter, 4% for clay loams, and 2% for sandy loams to maximum of 20% by volume.

.3 Contain no toxic elements or growth inhibiting materials.

.4 Finished surface free from:

.1 Debris and stones more than 50 mm diameter.
.2 Coarse vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
.3 Consistency: friable when moist.

.5 Topsoil is only to be imported if there is a shortage of suitable topsoil available on site for reuse, at no cost to the Owner.

2.2 GRAVEL PAVING

.1 Granular 'A' as per Section 02701 - Aggregates: General.

2.3 SOIL AMENDMENTS

.1 Fertilizer:
.1 Complete commercial synthetic fertilizer with minimum 65% insoluble nitrogen.
.2 Formulation ratio - 10 6 4, 10% nitrogen, 6% phosphoric acid, 4% potash.
.3 pH range of 6.5 to 8.0.

.2 Peatmoss:
.1 Derived from partially decomposed fibrous or cellular stems and leaves of species of Sphagnum Mosses.
.2 Elastic and homogeneous, brown in colour.
.3 Free of wood and deleterious material which could prohibit growth.
.4 Shredded particle minimum size 5 mm.
.5 pH range of 3.5 to 6.5.

.3 Sand: washed coarse silica sand, medium to coarse textured.

.4 Limestone:
.1 Ground agricultural limestone containing minimum calcium carbonate equivalent of 85%.
.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.5 Bonemeal: finely ground with a minimum analysis of 20% phosphoric acid.

2.4 SOURCE QUALITY CONTROL

.1 Advise Consultant topsoil sources to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to supply topsoil as specified.

.3 Soil testing by recognized testing facility for pH, P and K, and organic matter.

.4 Testing of topsoil will be carried out by a testing laboratory designated by the Consultant. Soil sampling, testing and analysis to be in accordance with Provincial standards.

PART 3 - EXECUTION

3.1 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct. If discrepancies occur, notify the Consultant and do not commence work until instructions have been received.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage. Remove soil contaminated with toxic materials. Dispose of removed materials as directed by Consultant, in accordance with the Geotechnical Report and the Contractor's Soil Management Plan.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to depth of minimum 25 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

.5 Planting soil for planting of trees, shrubs, and ground covers: mix 4 parts topsoil with 1 part peatmoss. Incorporate bonemeal into planting soil at rate of 0.5 kg/m^3 of soil mixture.

3.2 PLACEMENT AND SPREADING OF TOPSOIL - PLANTING SOIL

.1 Spread topsoil after subgrade has been approved. Refer to Contract Drawings for direction of surface drainage. Topsoil to be placed in all areas where existing grassed areas were disturbed by trench excavation.

.2 Spread topsoil with adequate moisture in uniform layers not exceeding 150 mm, over approved, unfrozen subgrade, where sodding, seeding and planting is indicated.

.3 For sodded areas keep topsoil 15 mm below finished grade.

.4 Spread topsoil to following minimum depths after settlement unless otherwise specified in the drawings, 80% compaction:

.1 100 mm for seeded areas

.2 150 mm for sodded areas.

.5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

.6 Avoid spreading or grading in wet, frozen, or saturated state.

3.3 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by the Consultant. Leave surfaces smooth, uniform and firm against deep foot printing.

3.4 ACCEPTANCE

.1 Consultant will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.5 SURPLUS MATERIAL

.1 Dispose of materials off site as directed by the Consultant, in accordance with the Geotechnical Report and the Contractor's Soil Management Plan.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Provide product data for:
- .1 Seed
- .2 Mulch
- .3 Tackifier
- .4 Fertilizer

.2 Submit in writing to Consultant five (5) days prior to commencing work:
- .1 The volume capacity of a hydraulic seeder in litres.
- .2 Amount of material to be used per tank based on volume.
- .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.2 SCHEDULING

.1 Schedule hydraulic seeding to coincide with preparation of soil surfaces.

.2 Schedule hydraulic seeding using grass mixtures and mixtures containing Crown vetch or Trefoil between dates recommended by the Ontario Ministry of Agriculture, Food and Rural Affairs.

1.3 DELIVERY AND STORAGE

.1 Deliver grass seed in original containers showing:
- .1 analysis of seed mixture
- .2 percentage of pure seed
- .3 the year of production
- .4 net mass
- .5 date when tagged and location
- .6 percentage germination
- .7 name and address of the distributor

.2 Deliver wood fibre mulch in moisture-proof containers bulk indicating manufacturer, content and net air-dry mass.

.3 Deliver erosion control agent in moisture-proof containers showing manufacturer, content and net mass.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Grass Seed: certified Canada No.1 grade to Government of Canada, Seeds Regulations and having minimum germination of 75% and minimum purity of 97%.

.2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated,

green colouring, free of germination and growth inhibiting factors with following properties:

.1 Type I mulch:
  .1 Made from wood cellulose fibre.
  .2 Organic matter content: 95% plus or minus 0.5%.
  .3 Value of pH: 6.0.
  .4 Potential water absorption: 900%.

.2 Type II mulch:
  .1 Made from newsprint, raw cotton fibre and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.
  .2 Fiber: wood or wood cellulose fiber free of germinating or growth-inhibiting ingredients and forming blotter like ground cover allowing absorption and percolation of water.

.3 Tackifier: Organic straw mulch tackifiers may include wood and fibre paper mulch or guar and starch based tackifiers. Asphalt based tackifiers are not acceptable.

.4 Water: potable, free of impurities that would inhibit germination.

.5 Inoculants: inoculant containers shall be tagged with an expiry date.

.6 Fertilizer: complete synthetic, slow-release fertilizer with maximum 35% water soluble nitrogen. Apply fertilizer at rates based on soil analysis.

2.2 GRASS SEED MIXTURE

.1 Grass Seed Mix
  .1 30% Jasper Creeping Red Fescue
  .2 15% Spartan Hard Fescue
  .3 10% Banff Kentucky Bluegrass
  .4 15% Canada Wild Rye
  .5 15% Little Bluestem
  .6 10% Indian Grass
  .7 5% Big Bluestem

.2 Seed at the rate of 150 kg/ha.

PART 3 - EXECUTION

3.1 WORKMANSHIP

.1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities or any other surfaces not intended to be sprayed.

.2 Keep the site well drained.

.3 Clean up immediately, any materials sprayed on where not intended, soil, mulch, or other debris spilled onto the pavement, dispose of deleterious materials.

.4 Take reasonable care to prevent contamination by seeding slurry of structures, sign, guide rails, fences and utilities.

.5 Where contamination occurs, remove seeding slurry to satisfaction of, and by means approved by Consultant.

.6 Do not perform work under adverse field conditions such as wind speeds more than 10 km/h, frozen ground or ground covered with snow, ice or standing water.

.7 Protect seeded areas from trespass until plants are established.

3.2 PREPARATION OF SURFACES

.1 Verify that grades are correct and prepared in accordance with Section 02911 - Topsoil and Finish Grading. If discrepancies occur, notify Consultant and do not commence work until instructed by Consultant.

.2 Cultivate areas to be seeded to a depth of 25mm and fine grade until free of humps and hollows and deleterious and refuse material.

.3 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

3.3 SEEDING

.1 Seeding and mulching operations shall only be carried within the following periods, where soil humidity allows germination and growth:
- .1 Spring period: May 1 to June 15
- .2 Fall period: August 15 to October 31

.2 Apply when winds less than 10 km/h using equipment suitable for area involved to the approval of the Consultant.

.3 Measure quantities of material by mass or mass-calibrated volume measurement to satisfaction of Consultant.

.4 Charge the seeder with water, mulch, seed, fertilizer and mix thoroughly. Add material into the seeder under agitation. Pulverize and add material slowly into the seeder under agitation.

.5 Add erosion control agents, into seeder and mix thoroughly to complete seeding slurry.

.6 Complete slurry to be applied per hectare:
- .1 Seed mixture as specified 150 kg
- .2 Mulch 2000 kg
- .3 Tackifier: 230 kg.
- .4 Water, minimum 30,000 L
- .5 Fertilizer: 300 kg, ratio 8:32:16.

.7 Apply slurry uniformly, at the optimum angle of application for adherence to the surfaces and germination of seed.
- .1 Using the correct nozzle for the application.
- .2 Using hoses for surfaces which are difficult to reach and to control application.

.8 Ensure a uniform dispersal of the mixed material over the entire area designated for seeding and the spray does not dislodge soil or cause erosion.

.9 Blend applications into existing, adjacent grass areas or sodded areas to form uniform surfaces.

.10 Protect all seeded areas from damage by water erosion, pedestrians and vehicles.

3.4 MULCHING

.1 Apply mulch only slurry over low maintenance turf grass areas at a rate of 1000 kg/ha, following seed application by mechanical seeder.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform the following operations from time of seed application until acceptance by Consultant.
- .1 Ensure maintenance equipment is suitable, to Consultant's acceptance.
- .2 Keep soil moist during germination period and adequately water grassed areas until as directed by Consultant.
- .3 Apply water to ensure moisture penetration of 75 to 100 mm. Control sprinkling to prevent washouts.
- .4 Cut grass when it reaches height of 70 mm and cut to height of 50 mm. Remove clippings which exceed 10 mm in length which may smother grass.
- .5 Maintain grassed areas free of pests and disease.
- .6 Adjust protection barrier as necessary to protect against deterioration due to pedestrian or other traffic as needed.

3.6 ACCEPTANCE

.1 Seeded areas will be accepted by Consultant provided that:
- .1 Seeded areas are uniformly established, and free of rutted, eroded, bare or dead spots and extent of weeds.
- .2 Turf is free of eroded, bare or dead spots and 98% free of weeds.
- .3 No surface soil is visible when grass has been cut to height of 50 mm.
- .4 Seeded areas have been cut at least twice, the last cut being carried out within 24 hours of acceptance.

.2 Areas seeded in fall will be accepted in following spring one month after the start of the growing season, provided acceptance conditions are fulfilled.

3.7 MAINTENANCE DURING WARRANTY PERIOD

.1 Perform following operations from time of acceptance until the end of warranty period:
- .1 Repair and reseed dead or bare spots to the satisfaction of the Consultant.
- .2 Mow seeded areas and remove clippings, as directed by Consultant.
- .3 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.

END OF SECTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation of polymeric geotextiles used to:
  .1 Separate and prevent mixing of granular materials and subgrade/native backfill.
  .2 Separate and prevent mixing of granular materials of different grading.
  .3 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

1.2 REFERENCES

.1 Ontario Provincial Standard Specifications (OPSS)
  .1 OPSS 1860, Material Specification for Geotextiles.

1.3 SUBMITTALS

.1 Submit mill test data and certificate to Consultant at least one week prior to start of work.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris, and rodents.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, and corrugated cardboard packaging material in appropriate on-site bins for recycling.

.4 Fold up metal banding, flatten, and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 GEOTEXTILE FILTER FABRIC

.1 Geotextile Filter Fabric: Class II, non-woven as per OPSS 1860 with filtration opening size of less than 150 microns.

.2 Securing Pins and Washers: Grade 300W, hot-dipped galvanized with minimum zinc coating of 600g/m^2.

2.2 EROSION CONTROL GEOTEXTILE

.1 Erosion Control Geotextile: Single Net Straw Biodegradable Rolled Erosion Control Product.

.2 Securing pins: 200 mm untreated wooden stakes or pegs or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Place geotextile material by unrolling onto graded surface in orientation and manner as per manufacturer's instructions, and in locations indicated on drawings, and retain in position with weights.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.

.4 Overlap each successive strip of geotextile 600 mm minimum over previously laid strip.

.5 Pin successive strips of erosion control geotextile with securing pins, installed 300 mm on centre at top and bottom of slope, and 1000 mm on centre in all other locations.

.6 Pin successive strips of geotextile fibre fabric with securing pins at 400 mm interval at mid-point of lap.

.7 Protect installed geotextile material from displacement, damage, or deterioration before, during, and after placement of material layers.

.8 Upon installation of erosion control geotextile, cover with overlying layer within 4 (four) hours of placement.

.9 Replace damaged or deteriorated geotextile to approval of Consultant.

.10 Place and compact soil layers in accordance with Section 02315 – Excavating, Trenching, and Backfilling.

3.2 CLEANING

.1 Remove construction debris from project site and dispose of debris in an environmentally responsible and legal manner.

3.3 PROTECTION

.1 Vehicular traffic not permitted directly on geotextile.

.2 Do not overload soil or aggregate covering on geotextile.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Concrete Institute (ACI):
- .1 ACI 303R, Guide to Cast-in-Place Architectural Concrete Practice.
- .2 ACI 347, Guide to Formwork for Concrete.
- .3 ACI 347.2R, Guide for Shoring/Reshoring of Concrete Multistory Buildings.
- .4 ACI Standard SP004, Formwork for Concrete.

.2 Canadian Standards Association (CSA):
- .1 CAN/CSA A23.1, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA A23.2, Methods of Test for Concrete.
- .3 CAN/CSA O86, Engineering Design in Wood.
- .4 CAN/CSA O121, Douglas Fir Plywood.
- .5 CAN/CSA O141, Softwood Lumber.
- .6 CAN/CSA O151, Canadian Softwood Plywood.
- .7 CAN/CSA S269.1, Falsework and Formwork.

.3 National Lumber Grades Authority (NLGA):
- .1 Standard Grading Rules for Canadian Lumber.

.4 Underwriters' Laboratories of Canada (ULC):
- .1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene Boards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01330 – Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's instructions, printed Product literature and data sheets for proprietary materials used in formwork liners and rigid insulation. Include Product characteristics, performance criteria, physical size, finish, and limitations.
- .2 Submit two (2) copies of WHMIS SDS in accordance with Division 01.

.3 Shop Drawings:
- .1 Submit drawings for formwork stamped and signed by professional engineer registered or licensed in the Province of Ontario, Canada.
- .2 Prepare Shop Drawings in accordance with CSA S269.1 for formwork.
- .3 Indicate formwork design data: Permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork.
- .5 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.
- .6 Shoring and bracing required to resist loads due to wet concrete, forms, wind and other forces arising from use of equipment to place concrete.
- .7 Indicate sequence of erection and removal of formwork.

1.3 QUALITY ASSURANCE

.1 Retain a professional engineer registered or licensed in the Province of Ontario, Canada, with experience in formwork design of comparable complexity and scope, to perform following services as part of work of this Section:
- .1 Design of formwork.
- .2 Review, stamp, and sign fabrication and erection Shop Drawings, design calculations and amendments.
- .3 Conduct on-site inspections and prepare and submit inspection reports verifying this part of work is in accordance with Contract Documents and reviewed Shop Drawings. Perform inspections prior to placing concrete.

.2 Design, construct, and dismantle formwork in accordance with the requirements of CAN/CSA A23.1, CSA S269.1, and ACI Standard SP004 unless more stringent tolerances are specified.

.3 Prior to placing concrete, ensure Concrete Quality Control Plan steps have been undertaken, including verification of installation and use of formwork.

.4 Pre-installation Meetings: in accordance with Division 01, convene pre-installation meeting one (1) week prior to beginning concrete works.
- .1 Ensure site supervisor, Consultant, formwork contractor and materials testing agent attend.
  - .1 Verify project requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, handle all materials in accordance with Division 01.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect formwork from damages.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 For exposed concrete use formwork materials to stricter requirements of CSA-A23.1/A23.2 and ACI-303.

.2 Form Ties:
- .1 Unexposed Concrete Surfaces: Snap ties, coil ties, or she-bolts to suit application.
- .2 Acceptable Manufacturer: National Concrete Accessories or approved alternate.

.3 Form release agent: Proprietary, non-volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete. Acceptable Manufacturer: W.R. Meadows or approved alternate.

.4 Sealant:

.1 Refer to Section 07920 - Joint Sealants.

PART 3 - EXECUTION

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels, and centres before proceeding with formwork and ensure dimensions agree with Drawings.

.2 Verify the locations of all inserts, anchor bolts, embedded components, etc., with all discipline Drawings and Shop Drawings prior to proceeding with formwork and report any discrepancies to the Consultant.

.3 Fabricate and erect formwork in accordance with CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances specified in CAN/CSA A23.1. Top form ties shall not be located within 150 mm of the top of the concrete placement.

.4 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.5 Align form joints and make watertight. Keep form joints to minimum.

.6 Install 25 mm triangular wood chamfer strips in corners of forms for all equipment bases which will be exposed in the finished structure.

.7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.8 Ensure that anchors and inserts will not protrude beyond surfaces designate to receive applied finishes, including painting.

.9 Apply non-reactive form release agent prior to placing reinforcing, unless noted otherwise.

.10 Do not close forms before reinforcing and embedded elements have been reviewed.

.11 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Contractor to be responsible for safety of structure, both before and after removal of forms until concrete has reached its specified compressive strength.

.2 Formwork shall be removed in coordination with the curing requirements outlined in CSA A23.1, the Contractor’s Concrete Quality Control Plan and Section 03300 - Cast-In-Place Concrete.

.3 Leave formwork in place for following minimum periods of time after placing concrete.

.1 Two (2) days for raft slab foundations and exterior equipment pads.

.4 Remove formwork when concrete has reached 70% of its 28-day design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.1 Demonstration of sufficient compressive strength for formwork removal shall come from test

results from field cured cylinders or pull testing to ASTM C900.

.5 The Contractor shall be responsible for any damage that occurs to the concrete as a result of early removal of formwork.

.6 Fill all cone tie holes with an approved non-shrink, non-metallic grout.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCES

.1 ASTM International:
- .1 ASTM A123/A123M, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Produce for Detecting Embrittlement.
- .3 ASTM A641/A641M, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- .4 ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- .5 ASTM A722/A722M, Standard Specification for Uncoated High-Strength Steel Bars for Prestressing Concrete.
- .6 ASTM A767, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- .7 ASTM A1064/A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

.2 Canadian Standards Association (CSA):
- .1 CAN/CSA A23.1, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA A23.2, Test Methods and Standard Practices for Concrete.
- .3 CAN/CSA A23.3, Design of Concrete Structures.
- .4 CAN/CSA A23.4, Design of Precast Concrete Structures.
- .5 CAN/CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.
- .6 CAN/CSA S413, Parking Structures.
- .7 CAN/CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Reinforcing Steel Institute of Canada (RSIC):
- .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01330 - Submittal Procedures.

.2 Shop Drawings:
- .1 Prepare reinforcing steel Shop Drawings in accordance with RSIC Manual of Standard Practice that conform to the Drawings with respect to placement, quantity, and size of reinforcing steel bars.
- .2 Shop Drawings shall contain the following information:
  - .1 Element location.
  - .2 Materials, grade and finishes of reinforcing.
  - .3 Sizes, spacings, lengths and locations of reinforcement, with identifying labels.
  - .4 Bar bending details.
  - .5 Concrete cover.
  - .6 Placement of reinforcement at all openings, depressions, spandrels, joints, interfaces and sleeves.
  - .7 Show inserts, anchor bolts, etc.
- .3 Detail to requirements of CAN/CSA-A23.1 and RSIC, Reinforcing Steel Manual of Standard Practice. Ensure adjustments are made in detailing of reinforcing steel for splices and development lengths. Splice lengths are to be based on bar position within section (e.g. top bars) and reinforcement coatings (e.g., epoxy).

.4 Reinforcing steel Shop Drawings shall be reviewed and accepted in accordance with the Concrete Quality Control Plan prior to submitting to the Consultant.

.5 Shop Drawings shall be in a single, complete set in order that all details may be read in conjunction with plans, elevations, and all other dependent details. Quantity and format of Shop Drawings are to be in accordance with Division 01. Reproduction of Contract Documents will not be acceptable as Shop Drawings.

.6 Shop Drawings shall correspond to each detail on drawing. Each wall, slab, etc. to be separately listed. Bar lists, where provided, shall be reviewed only for general conformity, quantities are not checked in detail.

.7 All details and sections to be to a scale of not less than 1:25.

.8 The construction Drawings show reinforcing steel placement for the project that shows the intent of reinforcing of concrete elements. These Drawings can accomplish this description through the use of nomenclature such as similar and typical, indicating similar arrangements of reinforcing steel within concrete elements but potential variation of formed dimensions and lengths to accommodate the intended final construction.

.9 The reinforcing steel Shop Drawings shall be of sufficient detail to allow for a clear understanding of the fabrication limits, quantity, and placement of all reinforcing steel on the project.

.3 Submit reinforcing steel mill certificates certifying that the reinforcing steel bars conform to the project Specifications and showing the chemical composition of the reinforcing steel and mechanical properties.

1.3 QUALITY ASSURANCE

.1 Pre-installation Meetings: In accordance with Division 01, convene pre-installation meeting one (1) week prior to beginning concrete works.

.1 Ensure site supervisor, Consultant, Reinforcing Steel Supervisor and materials testing agent attend.

.1 Verify project requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle all materials in accordance with CAN/CSA A23.1 and the RSIC Manual of Standard Practice.

1.5 SUBSTITUTES

.1 Substitution of different size bars permitted only upon written approval of Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and the RSIC, Reinforcing Steel Manual of Standard Practice.

.2 Reinforcing bars: To CSA G30.18, Grade 400W, deformed billet steel sourced from North American mills.

.3 Plain round bars: To CSA G40-20/G40.21.

.4 Cold-drawn annealed steel wire ties: 1.5 mm diameter to ASTM A1064/A1064M.

.5 Slab Bolsters and High Chairs: To suit application. For exposed concrete, chairs and bolsters to be plastic tipped or stainless steel. For sandblasted or bush-hammered concrete surfaces, chairs and bolsters to be stainless steel.

.6 Smooth Dowel Caps: Plastic (non-ferrous) dowel caps to permit movement of plain round bar in construction joint. Acceptable Product: Dowel Caps by Deslaurier Inc.

.7 Field touch-up paint for galvanized reinforcing to be zinc rich galvanized paint with a minimum of 90 zinc solids. Acceptable Product: 'Galvafroid' by Fosroc or approved alternate.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

.1 Place and protect reinforcing steel in accordance with CAN/CSA-A23.1 and the Concrete Quality Control Plan of Section 03300 Cast-in-Place Concrete.

.2 Before placing, clean all reinforcement of any loose scale, dirt, or any other coatings that would impair the bond.

.3 Place reinforcement accurately and secure in place by use of chairs, spacers, and hangers to prevent displacement of reinforcement from intended bar position. Do not wet-set reinforcement.

.4 Maintain cover to reinforcement during concrete placement and ensure welded wire fabric is lifted during concrete placement.

.5 Specified cover to reinforcing steel as noted on Drawings.

.6 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.

.7 Reinforcing steel development lengths to be in accordance with CSA A23.3.

.8 Reinforcing steel lap splices lengths to be in accordance with CSA A23.3.

.1 All lap splices to be Class 'B' for tension and 1.3 x compression development length for compression.

.2 Bars shall be securely fastened together unless noted otherwise. Where permitted by the Consultant, non-contact lap splices in flexural members shall have a transverse spacing not exceeding the lesser of one-fifth of the required lap splice length of 150 mm.

.9 Detail and fabricate all hooks and bends in reinforcing steel to be standard in accordance with CSA A23.1

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.

.2 Straightening or re-bending of reinforcing bars is not permitted. Discard bars with bends or kinks not shown on bar lists.

.3 When field bending is authorized, bend without heat, applying slow and steady pressure.

.4 Replace bars which develop cracks or splits.

3.3 INSERTS AND OPENINGS

.1 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Consultant before placing of concrete.

.2 Unless otherwise noted, provide hooked ends at all reinforcing terminated at openings in walls and slabs. Refer to Drawings for additional reinforcing around openings.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Concrete Institute (ACI):
- .1 ACI 207.1R, Guide to Mass Concrete.
- .2 ACI 211.2, Standard Practice for Selecting Portions for Structural Lightweight Concrete.
- .3 ACI 212.3R, Report on Chemical Admixtures for Concrete.
- .4 ACI 213R, Guide for Structural Lightweight Aggregate Concrete.
- .5 ACI 301, Specifications for Structural Concrete.
- .6 ACI 302.1R, Guide for Concrete Floor and Slab Construction.
- .7 ACI 303R, Guide to Cast-in-Place Architectural Concrete Practice.
- .8 ACI 305R, Guide to Hot Weather Concreting.
- .9 ACI 306R, Guide to Cold Weather Concreting.
- .10 ACI 360R, Guide to Design of Slabs-on-Ground.
- .11 ACI 544.1R, Report on Fiber Reinforced Concrete.
- .12 ACI 544.2R, Measurement of Properties of Fiber Reinforced Concrete.
- .13 ACI 544.4R, Guide to Design with Fiber-Reinforced Concrete.

.2 ASTM International (ASTM):
- .1 ASTM A820/A820M, Standard Specification for Steel Fibres for Fiber-Reinforced Concrete.
- .2 ASTM C33M, Standard Specification for Concrete Aggregates.
- .3 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
- .4 ASTM C330M, Standard Specification for Lightweight Aggregates for Structural Concrete.
- .5 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
- .6 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .7 ASTM C1116, Specification for Fibre-Reinforced Concrete and Shotcrete.
- .8 ASTM C1609/C1609M, Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading).
- .9 ASTM C1074, Standard Practise for Estimating Concrete Strength by the Maturity Method.
- .10 ASTM 567M, Standard Test Method for Determining Density of Structural Lightweight Concrete.

.3 CSA Group (CSA)
- .1 CAN/CSA A23.1, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA A23.2, Methods of Test for Concrete.
- .3 CAN/CSA-A23.3, Design of Concrete Structures.
- .4 CAN/CSA A283, Qualification Code for Concrete Testing Laboratories.
- .5 CAN/CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .6 CAN/CSA S413, Parking Structures.
- .7 CAN/CSA S900.2, Structural Design of Wastewater Treatment Plants.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
- .1 Safety Data Sheets.

.5 International Concrete Repair Institute (ICRI):
- .1 ICRI Technical Guideline No. 310.1R, Guideline for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.

.2 ICRI Technical Guideline No. 310.2R, Guideline for Selecting and Specifying Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01330 – Submittal Procedures.

.2 Concrete Producer:
- .1 Provide Consultant within fourteen (14) Working Days of commence work date with a valid and recognized certificate from the plant delivering concrete.
- .2 Concrete Producer to have a minimum of ten (10) years construction experience in industrial facilities and be experienced in performance-based Specifications.
  - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture meet specified requirements.
- .3 Consultant may reject proposed Concrete Producer who does not meet the requirements or have proven ability to perform the work.

.3 Submit concrete mix designs including as a minimum:
- .1 Intended use.
- .2 Exposure Class based on CSA A23.1.
- .3 Minimum Compressive strength at age.
- .4 Maximum water to cementing materials ratio.
- .5 Nominal maximum aggregate size.
- .6 Slump range.
- .7 Plastic air content (%).
- .8 List of all supplemental cementing materials, including percentage (if used).
  - .1 Where High Volume Supplementary Cementitious Materials Type 1 or 2 are proposed by the Concrete Producer indicate additional curing requirements.
- .9 List of all admixtures (if used).
- .10 Acceptable placement methods (i.e., chute, pump, etc.).
- .11 Identify any limitations that would limit the use of concrete mix for intended use (i.e., cold weather work).
- .12 Where the planned placement method or environmental conditions in the field differ from the acceptable parameters listed in the previously accepted concrete mix design(s), submit new/revised concrete mix designs for review and acceptance by the Consultant.

.4 Product Data:
- .1 Submit manufacturer's instructions, printed Product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include Product characteristics, performance criteria, physical size, finish, and limitations.
- .2 Submit two (2) copies of WHMIS SDS.

.5 Site Quality Control Submittals:
- .1 Provide testing and inspection results and reports for review by Consultant and do not proceed without written approval when deviations from mix design or parameters found.
- .2 Concrete pours: Provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described the Concrete Quality Control Plan.
- .3 Concrete hauling time: Provide for review by Consultant deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of work and discharged after

batching.

1.3 PERFORMANCE BASED SPECIFICATION

.1 Concrete producer to meet the concrete performance criteria established within this Specification.

1.4 MATERIAL TESTING DURING CONSTRUCTION

.1 The Owner will appoint a third-party Material Testing Agent to verify the cast-in-place concrete meets the mix design requirements outlined in this Specification.

.2 Notify Materials Testing Agent a minimum of two (2) Working Days prior to placement of concrete.

.3 Testing requirements and frequency are to be as per CAN/CSA A23.1/A23.2. The Contractor shall cast a minimum of three cylinders per compressive strength test.

.4 Submit laboratory testing results within five (5) Working Days of completing test.

.5 The third-party Materials Testing Agent will be paid by the Owner through the cash allowance. Supply all necessary cooperation.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle all materials in accordance with the Concrete Quality Control Plan. Ensure all concrete materials are handled in accordance with CSA A23.1.

.2 Concrete to be delivered to site and discharged within 120 minutes maximum after batching.

.3 Continuous concrete delivery from plan shall meet CSA A23.1/A23.2.

PART 2 - PRODUCTS

2.1 CONCRETE

.1 Use ready-mix concrete. All constituent materials shall conform to the requirements of CAN/CSA-A23.1.

.2 Concrete mix design shall comply with requirements of CAN/CSA-A23.1 based on Alternative No. 1 in Table 5. Ready-mix concrete to be proportioned mixed and delivered in accordance with CAN/CSA-A23.1.

.3 Pump mix designs shall not be modified from normal concrete mix designs by the changing cement content or quantities of coarse and fine aggregate.

.4 Use 20 mm maximum coarse aggregate unless noted.

.5 Refer to the Contract Drawings for concrete mix design requirements and class of exposure.

.6 Slump shall be determined by the Concrete Producer to meet workability requirements for concrete placement for the project.

2.2 ADMIXTURES

.1 Admixtures other than air entraining and water reducing agents are not permitted unless approved by Consultant. Calcium chloride shall not be used.

.2 Air Entraining Admixture: To ASTM C260.

.3 Chemical Admixtures: To ASTM C494. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.

.4 Water Reducing Agent: To ASTM C494, non-chloride.

.5 Retardation Agent: To ASTM C494, non-chloride.

.6 Superplasticizer: To ASTM C494, use only when approved by Consultant.

2.3 GROUT

.1 Shrinkage compensating grout for general applications:

.1 Non-shrink, non-metallic cementitious grout capable of developing compressive strength of 30MPa at 7 days.

.2 Acceptable Products: ‘SikaGrout 212’ by Sika Canada, ‘High Strength Precision Grout’ by Five Star Products Inc., ‘1428 HP’ Mineral Based Precision Grout by W.R. Meadows Inc., or approved alternate.

PART 3 - EXECUTION

3.1 PLACING

.1 Place concrete in accordance with CAN/CSA-A23.1.

.2 Prior to placing concrete for elements bearing on grade, verify that subgrade has been compacted and accepted by Geotechnical Consultant.

.3 Prior to placement of concrete ensure all pre-placement inspection processes and assembled documentation has been carried out to conform to the Concrete Quality Control Plan.

3.2 COLD WEATHER REQUIREMENTS

.1 Carry out cold weather concreting in accordance with the requirements of CAN/CSA A23.1 and the Concrete Quality Control Plan. Protection shall be provided by means of heated enclosures, coverings, insulation, or a suitable combination of these methods.

.2 Placing concrete against subgrade surface with temperature below 5°C is prohibited. Employ suitable means to maintain surface temperatures at minimum 5°C. Verify through credible forms of temperature measurement.

.3 Placing concrete upon or against other surfaces such as formwork with surface temperature below 5°C is prohibited. Employ suitable means to maintain surface temperatures at a minimum of 5°C. Verify through credible forms of temperature measurement.

.1 Alternatively, the use of non-chloride, non-corrosive accelerators are to be used when reviewed and accepted by the Consultant to meet the minimum ambient temperatures required for the concrete placement.

.4 When the air temperature is at or below 5°C or there is a likelihood of it falling to that limit within the curing period, employ suitable means to maintain temperature of all concrete surfaces at a minimum of 10°C for the duration of the required curing period. Provide sufficient thermometers, in accordance with CAN/CSA A23.1.

.5 Remove and replace any portion of concrete allowed to freeze prior to reaching a compressive strength of at least 10 MPa.

.6 At the time of placing and during the curing period, all concrete surfaces shall be protected from direct exposure to combustion gases by formwork or an impermeable membrane. Provision shall be made for venting of all combustion products from gas-fired heaters. Repair any concrete damaged by carbonation.

.7 The Contractor shall employ a protection methodology near the end of the curing period to ensure the temperature differential between the concrete surface and ambient is less than that described in Table 20 of CSA A23.1.

3.3 HOT WEATHER REQUIREMENTS

.1 Carry out hot weather concreting in accordance with requirements of CAN/CSA A23.1 and the Concrete Quality Control Plan when ambient air temperatures are above 27°C. Hot weather concreting measures shall include; cooling of the formwork, reinforcement, and concreting equipment by fogging and evaporation; cooling of concrete materials; provision of windbreak structures; shading; placement timing; or a suitable combination of these methods.

.2 Site conditions (air temperature, humidity, and wind speed) shall be monitored as per ACI 305 to assess the need for evaporation control measures no later than one (1) hour before the start of concrete placing operations and continuing at intervals not exceeding 30 minutes until specified curing procedures have been applied.

.3 Curing measures should be implemented immediately following completion of finishing operations and efforts shall be made to protect the concrete from low humidity, drying winds and extreme ambient temperature differential.

3.4 INSERTS AND OPENINGS

.1 Set sleeves, ties, hangers, waterstops, anchor bolts and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 200 mm not indicated on structural Drawings must be approved by Consultant.

.2 No sleeves, ducts, pipes or other openings shall pass through beams, column capitals or columns, except where specifically detailed on structural Drawings or reviewed by Consultant.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from Consultant before placing of concrete.

.4 Coordinate locations and sizes of sleeves and openings shown on structural Drawings with architectural, mechanical and electrical Drawings.

.5 Set all anchor bolts using templates provided by appropriate trade requiring same. Securely fasten anchor bolts in place to maintain correct position and alignment during concreting. Misplaced anchor bolts shall be considered defective concrete and shall be removed and replaced or otherwise corrected to Consultant's satisfaction.

3.5 FINISHING AND CURING

.1 Refer to Section 03500 – Concrete Finishing and Curing.

3.6 REPAIR OF NON-CONFORMING CONCRETE

.1 When directed by the Consultant, repair procedures are to be designed by a Professional Engineer registered in Province of Ontario, Canada.

END OF SECTION

Concrete Placement Report (Sample)

Project Name:	Contractor Name:	
Description/Location of Placement:		
Date of Placement:		
Concrete Mix Design:		
Mix Design # _____	Exposure Class: _____	
Compressive Strength @ 28/56 Days: _____Mpa	Air Content (%): _____	
Quantity (m^3):	Slump: _____	
Site Testing Results: Slump:	Air %:	
Time of Concrete Arrival:	Placement Start:	Placement Finish:
Concrete Placement Methodology:		
Confirmation of Any Heating/Cooling Requirements:		
Confirmation of Curing Type:	Curing Duration:	

	Personnel Responsible for Verification (printed)	Initials and date
Pre-Placement Checklist:		
Verification of subgrade preparation.		
Verification of layout .		
Verification of formwork and falsework.		
Verification of placement of reinforcing steel .		
Verification of Concrete Accessories, Inserts, anchor bolts and openings.		
Verification of mechanical/electrical embeds.		
Overall Release (Civil Foreman) Signature:	Date:	

	Personnel Responsible for Verification (printed)	Initials and date
Placement Checklist:		
Monitoring of protection of surroundings during placement.		
Monitoring of concrete placement and finishing.		
Monitoring of movement of falsework and formwork during placement.		
Monitoring of embedments during placement.		

	Personnel Responsible for Verification (printed)	Initials and date
Post-Placement Checklist:		
Date and time of formwork removal.		
Curing practices used.		
Final concrete inspection.		

*NOTE: Modify this form as requied to suit the project specific requirements.

Concrete Curing Log (Sample)

Project Name:_____ Contractor Name:_____

Concrete Pour Log					Curing Type		Temperature Reading						
Pour #	Description / Location of Pour	Date	Mix #	Quantity (m^3)	Curing Duration	Curing Method	24 Hrs	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
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21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
32													
33													
33													
	do not use this line												

*NOTE: Modify this form as required to suit the project specific requirements and activities. Multiple forms with multiple temperature reading locations may be required depending on size of placement and element thickness and shall be developed in conjunction with the Contractor's Concrete Quality Control Plan.

Concrete Cylinder Log (Sample)

Project Name:_____ Contractor Name:_____

Concrete Pour Log					Testing Result Summary					
Pour #	Description / Location of Pour	Date	Mix #	Quantity (m^3)	# of Cylinders Taken	Measured Air Content %	Compressive Strength (MPa)			Meets Specs (Y/N)
							7 Day	28 Day (Cylinder 1)	28 Day (Cylinder 2)	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
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32										
33										
33										
	do not use this line									

*NOTE: Modify this form as required to suit the project specific requirements and activities.

PART 1- GENERAL

1.1 REFERENCES

.1 American Concrete Institute:
- .1 ACI 301, Specifications for Structural Concrete.
- .2 ACI 303R, Guide to Cast-in-Place Architectural Concrete Practice.
- .3 ACI 308R, Guide to External Curing of Concrete.

.2 ASTM International:
- .1 ASTM C171, Standard Specification for Sheet Materials for Curing Concrete.
- .2 ASTM C309, Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 ASTM C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- .4 ASTM E1155M, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric).

.3 Canadian General Standards Board (CGSB):
- .1 CAN/CGSB-25.20, Surface Sealer for Floors.

.4 CSA International:
- .1 CAN/CSA A23.1, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA A23.2, Methods of Test for Concrete.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
- .1 Safety Data Sheets (SDS).

.6 National Sanitation Foundation (NSF):
- .1 NSF/ANSI/CAN 61, Drinking Water System Components – Health Effects.
- .2 NSF/ANSI/CAN 600, Health Effects Evaluation and Criteria for Chemicals in Drinking Water.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01330 – Submittal Procedures.

.2 Product Data:
- .1 Provide manufacturer's printed Product literature and data sheets for concrete finishes and include Product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS Safety Data Sheets for all Products.
- .3 Include application instructions for concrete floor treatment(s).

.3 Submit written declaration that the components used are compatible and will not adversely affect finished flooring Products and their installation adhesives.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle all materials in accordance with CSA A23.1 and manufacturers instructions.

PART 2 - PRODUCTS

2.1 CURING MATERIALS

.1 Materials used for curing shall be in accordance with CSA A23.1.

.2 Water shall be clean and shall not contain any deleterious substances. Water to meet the requirements of ASTM C94/C94M.

.3 Plastic film used as a moisture barrier for curing concrete shall comply with ASTM C171.

2.2 CURING AND SEALING COMPOUNDS

.1 For interior exposed applications:
- .1 Curing and Sealing Compounds, shall be a water based, VOC-compliant, clear, glossy, non-yellowing acrylic emulsion, conforming to CAN/CSA-A23.1 and ASTM C309 Type 1, and ASTM C1315 Type 1, Class A.
- .2 Acceptable Products:
  - .1 ‘Florseal WB-25’ by Sika Canada.
  - .2 ‘VOCOMP 30’ by W.R. Meadows.
  - .3 ‘Super Diamond Clear VOX’ by Euclid Chemical.
- .3 Provide white pigments to ASTM C309 Type II, Class A for hot weather concrete, where approved. Moisture loss not to exceed 4.0 kg/m^3 in a 72-hour period when tested per ASTM C156.

.2 Specified curing and sealing compounds may be used as sealers where specified on Drawings for existing concrete.

2.3 AGGREGATE HARDENERS

.1 Dry shake applied non-metallic aggregate, natural coloured.
- .1 Acceptable Products:
  - .1 ‘Diamag 7’ by Sika Canada.
  - .2 ‘MasterTop 100’ by Sika Canada.
  - .3 ‘785 Genflor’ non-metallic floor hardener by W.R. Meadows.
  - .4 ‘Surflex-TR’ by Euclid Chemical.

2.4 INTEGRAL CONCRETE HARDENER

.1 Integral applied Admixture:
- .1 Acceptable Product: ‘Hard-Cem’ by Kryton.

PART 3 - EXECUTION

3.1 FINISH FOR FORMED SURFACES

.1 Exposed Concrete Finish:
- .1 A "smooth-form finish" as defined by CAN/CSA-A23.1 will be required for all surfaces exposed to view in finished structure.
- .2 Utilize only new sheets of plywood coated with release agent and cone-type ties.
- .3 Patch all cone tie holes with an approved non-shrink, non-metallic grout.

3.2 CURING

.1 Cure all concrete in accordance with the requirements of CAN/CSA-A23.1.

.2 Curing compounds shall not be used in the following scenarios:
- .1 Where curing compounds are not compatible with specified finishes.
- .2 Wet curing methods shall be used during hot weather concreting, unless otherwise approved by the Consultant.

3.3 SURFACE PREPARATION

.1 All newly cast concrete to receive any proprietary waterproofing/sealing agent to be water blasted and/or prepared to manufacturer’s requirements. Consult manufacturer’s literature for requirements prior to applying any Products to newly cast concrete.

.2 Where moisture-sensitive finishes are to be applied to a concrete surface, the moisture conditions of the concrete shall be verified prior to its application in accordance with CSA A23.1 and manufacturer’s instructions.

3.4 FLOOR SEALING

.1 Unless noted otherwise, seal all exposed concrete floor areas, and exterior equipment pads, as well as concrete toppings with two coats of an approved sealing compound.

.2 Preparation of surfaces, quantities used, and application procedures and installation precautions to be in strict compliance with manufacturer’s instructions and directions.

3.5 FLOOR HARDENING

.1 Refer to the Drawings for extent and coverage rate of floor hardeners.

.2 Incorporate hardener into freshly floated concrete as a "dry shake". Adhere strictly to manufacturer's recommendations and directions.

.3 Incorporate integral hardener into the concrete mix at the time of batching for air-entrained concrete or for vertical or inclined applications. Adhere strictly to manufacturer's recommendations and directions.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCES

.1 American Wood-Preservers' Association (AWPA)
- .1 AWPA M2-11, Standard for Inspection of Treated Wood Products.
- .2 AWPA M4-11, Standard for the Care of Preservative-Treated Wood Products.
- .3 AWPA P5-07, Standard for Waterborne Preservatives.
- .4 AWPA E13-01, Standard Method of Testing to Determine Water Repellents in Pressure Treated Lumber.
- .5 AWPA U1-13, Use Category System: User Specification for Treated Wood.

.2 Underwriter's Laboratories of Canada (ULC)
- .1 CAN-ULC-S102.2-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.3 Canadian Standards Association (CSA International)
- .1 CSA O80 Series-08(R2012) - O80S2-05, Wood Preservation.
- .2 CSA O80.20-1.1-M97(R2002), This Standard applies to the fire-retardant treatment of lumber by pressure processes.
- .3 CSA O80.27-1.1-M97(R2002), This Standard covers the fire-retardant treatment of Douglas Fir, hardwood, softwood, and Poplar plywood by pressure processes.
- .4 CSA O80.201-M89, This Standard covers hydrocarbon solvents for preparing solutions of preservatives.
- .5 CSA O322-02(R2012), Procedure for Certification of Pressure-Treated Wood Materials for Use in Preserved Wood Foundations.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit Submittal submissions: in accordance with Section 01330 - Submittal Procedures.

.2 Quality assurance submittals:
- .1 Submit certificates in accordance with Section 01330 - Submittal Procedures.
- .2 For products treated with preservative fire-retardant by pressure impregnation submit following information certified by authorized signing officer of treatment plant:
  - .1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.
  - .2 Moisture content after drying following treatment with water-borne preservative fire-retardant.
  - .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

1.3 QUALITY ASSURANCE

.1 Plant inspection of products treated with preservative and fire-retardant by pressure impregnation will be carried out by designated testing laboratory to AWPA M2, and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.

.2 Each piece of lumber and plywood for preserved wood foundations to be identified by CSA O322 certified stamp.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.2 Separate waste materials for reuse and recycling in accordance with Division 01.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Products delivered to site must show certification mark of a Canadian Lumber Standards Accreditation Board (CLSAB), verifying that lumber has been treated in compliance to the applicable CSA treatment standard and that all quality assurance inspection procedures have been followed.

.2 Where pressure treated material is required, provide certified pressured treated material to the following minimum CLSAB Use Categories (UC) in accordance with CSA O80:

- .1 UC1: interior use, above ground, dry, protected from weather such, as but not limited to interior framing.
- .2 UC2: interior use, above ground, damp protected conditions, but can be exposed to dampness such as, but not limited to sillplates.
- .3 UC3.1: exterior use, above ground, protected by coating, free draining such as, but not limited to coated millwork, siding, trim.
- .4 UC3.2: exterior use, above ground, uncoated, exposed to all weather cycles such as, but not limited to foot and deck bridgeboards, joists, bridge and deck rails.
- .5 UC4.1: exterior use in normal ground and fresh water contact, exposed to all weather cycles such as, but not limited to fence posts and bridge decks with potential for transfer of dirt onto bridge deck and utility poles in low decay areas.
- .6 UC4.2: exterior use in ground and fresh water contact with high decay potential, exposed to all weather cycles such as, but not limited to permanent wood foundations, land, freshwater and foundation piles, building and utility poles in high decay areas.

.3 Provide fire-retardant lumber and plywood where indicated to the following minimum CLSAB Use Categories (UC) in accordance with CSA O80:

- .1 UCF.1: fire protection as indicated for locations protected from weather and sources of moisture such as, but not limited to roof trusses and sheathing, studs, joists and paneling.

.4 Structures wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

.5 Primers Paints Coatings: in accordance with manufacturer's recommendations for surface conditions.

.6 Coating: VOC limit 100 275 350 650 g/L maximum to GS-11 SCAQMD Rule 1113.

PART 3 – EXECUTION

3.1 APPLICATION: PERSERVATIVE

.1 Provide pressure treated material where indicated and where:

- .1 Wood is in ground contact,
- .2 Wood is within 450 mm of ground in localities known to have termites.

.3 Wood supported on moisture permeable materials is within 150 mm of the ground.

.4 Wood is subject to prolonged exposure to moisture in locations where the moisture index is greater than 1.00.

.5 Wood is used in permanent wood foundations.

.6 Wood is used in retaining walls or cribbing that contributes to the stability of the foundation or where retaining walls or cribbing are greater than 1.2 m in height.

.2 Following water-borne preservative treatment, dry material to maximum moisture content:

.1 Lumber: 19%.

.2 Plywood: 18%.

3.2 APPLICATION: FIELD TREATMENT

.1 Cut and site apply field treatment to preservative and fire-retardant material in accordance with manufacturer's written recommendations for intended use.

.2 Comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2.

.3 Remove chemical deposits on treated wood to receive applied finish.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCES

.1 American National Standards Institute/National Particleboard Association (ANSI/NPA)
- .1 ANSI/NPA A208.1-2009, Particleboard.

.2 ASTM International
- .1 ASTM A 111M/M 111-11, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A 653/A 653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealled) by the Hot-Dip Process.
- .3 ASTM C 578-11be1, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- .4 ASTM C 1289-12a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
- .5 ASTM C1396/C1396M-11, Standard Specification for Gypsum Board.
- .6 ASTM F1482-04(2009)e1, Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
- .7 ASTM D 1761-06, Standard Test Methods for Mechanical Fasteners in Wood.
- .8 ASTM D5055-13, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
- .9 ASTM D5456-11a, Standard Specification for Evaluation of Structural Composite Lumber Products.

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-11.3-M87, Hardboard.
- .2 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .3 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.
- .4 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.

.4 CSA International
- .1 CAN/CSA-A123.2-03(R2008), Asphalt Coated Roofing Sheets.
- .2 CAN/CSA-A247-M86(R1996), Insulating Fiberboard.
- .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .4 CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .5 CSA O121-08 (R2013), Douglas Fir Plywood.
- .6 CAN/CSA O122-06(R2011), Structural Glued-Laminated Timber.
- .7 CSA O141-05(R2009), Softwood Lumber.
- .8 CSA O151-09, Canadian Softwood Plywood.
- .9 CSA O153-13, Poplar Plywood.
- .10 CSA O325-07 (R2012), Construction Sheathing.
- .11 CSA O437 Series-93(R2011, Standards on OSB and Waferboard.
- .12 CSA-Z809-08, Sustainable Forest Management.

.5 Forest Stewardship Council (FSC)
- .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.

.6 National Lumber Grades Authority (NLGA)
    .1 Standard Grading Rules for Canadian Lumber 2010.

.7 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
    .1 SCAQMD Rule 1113-A2011, Architectural Coatings.
    .2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

.8 Sustainable Forestry Initiative (SFI)
    .1 SFI-2010-2014 Standard.

.9 The Truss Plate Institute of Canada
    .1 Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses 2007.

.10 Underwriters' Laboratories of Canada (ULC)
    .1 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01330 - Submittal Procedures.

.2 Product Data:
    .1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product characteristics, performance criteria, physical size, finish and limitations.
    .2 Submit manufacturer's instructions, printed product literature and data sheets for pressure treated preservative and fire-retardant material in accordance with Section 06070 – Wood Treatment.

1.3 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 All lumber shall be sound, straight, dressed all sides and kiln dried, and moisture content at any time during shipment and storage shall not exceed 19%.

.3 Grading: 120, National Grading Rule for Dimension Lumber.

.4 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
    .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    .2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Division 01.

PART 2 – PRODUCTS

2.1 MATERIALS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
- .1 CAN/CSA-O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
- .1 S2S in accordance with the following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber, 1987 edition.
- .2 Board sizes: "Standard" or better grade.
- .3 Dimension sizes: "Standard" light framing or better grade.
- .4 Post and timbers sizes: "Standard" or better grade.
- .5 Forest Stewardship Council (FSC) certified.
- .6 When installed over concrete block or poured concrete: Use Pressure Treated Wood.

.3 Panel Materials:
- .1 Douglas fir plywood (DFP): to CSA O121, standard construction, urea-formaldehyde free.
  - .1 Exterior locations: Canadian softwood plywood (CSP) to CSA O151, standard construction, exterior grade at all exterior locations.
- .2 Canadian softwood plywood (CSP), not exposed: to CSA O151, standard construction, urea-formaldehyde free.
  - .1 Interior locations, exposed: Canadian Softwood Plywood to CSA O151, Good One (1) Side (G1S) at all interior exposed locations.
- .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.

.4 Wood Preservative:
- .1 Refer to Section 06070 - Wood Treatment for fire-retardant treated wood and preservative-treated wood.

2.2 ACCESSORIES

.1 Fasteners: to CAN/CSA-G164, for exterior work interior highly humid areas pressure- preservative fire-retardant treated lumber.

.2 Nails, spikes and staples: to CSA B111.

.3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

.5 Suitable screw fasteners for anchorage of wood blocking to steel studs or structural steel.

.6 Suitable screw fasteners for anchorage of wood blocking in the roofing system as specified in the roofing section.

.7 Suitable screw fasteners for anchorage of wood to concrete.

PART 3 – EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate prior to commencing with Work of this section.
- .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Treat surfaces of material with wood preservative where indicated in accordance with Section 06070 - Wood Treatment.

.2 Confirm compatibility of treated surfaces with adjacent materials. Notify Consultant of unacceptable conditions immediately upon discovery. Proceed with treatment only after approval of adjacent materials are deemed acceptable. Treat material as indicated as follows:

- .1 Curbs, nailers, sleepers on roof deck.
- .2 Wood furring for wood products on outside surface of exterior masonry and concrete walls.

3.3 PRESSURE TREATED COMPONENTS

.1 Use preservative pressure treated lumber and plywood within exterior wall and roof systems and at other locations indicated in accordance with Section 06070 Wood Treatment.

.2 Where it is necessary to cut, bore or otherwise alter pressure treated components in the field, treat cut surfaces with heavy coat of wood preservative in accordance manufacturer’s written recommendations.

.3 Use fire retardant pressure treated plywood at backboards and where plywood is installed on steel stud framed wall, behind gypsum board and parapets extend beyond 610 mm / 2’-0”.

3.4 INSTALLATION

.1 Comply with requirements of latest version of the Ontario Building Code (OBC), supplemented by the following paragraphs.

.2 Construct and install work as indicated on Drawings.

.3 Machine dressed work shall be slow fed using sharp cutters and finished members shall be free from drag, feathers, slivers or roughness of any kind.

.4 Align and plumb faces of furring and blocking to tolerance of 1:600.

.5 Install members true to line, levels and elevations, square and plumb.

.6 Construct continuous members from pieces of longest practical length.

.7 Install spanning members with "crown edge" up.

.8 Frame materials with tight joints rigidly held in place.

.9 Be responsible for methods of construction and for ensuring that materials are rigidly and securely attached and will not be loosened by work of other trades.

.10 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.

.11 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.12 Install nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.13 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

.14 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

.15 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.16 Countersink bolts where necessary to provide clearance for other work.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01741 - Cleaning.

- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01741 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM C 612-10, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
- .2 ASTM C 726-12, Standard Specification for Mineral Fiber Roof Insulation Board.
- .3 ASTM E398-03(2009)e1Standard Test Method for Water Vapor Transmission Rate of Sheet Materials Using Dynamic Relative Humidity Measurement.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.3 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
- .3 CAN/ULC-S702-09-AM1, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .4 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01330 - Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01330 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01330 - Submittal Procedures. Indicate VOC's insulation products and adhesives.

.3 Manufacturer's Instructions:
- .1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Division 01.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Division 01.

PART 2 – PRODUCTS

2.1 INSULATION

.1 Rock / Mineral Wool Insulation for Exterior Cavity Walls:
- .1 Compliance: ASTM C612 Type IVB and CAN/ULC-S702 Type 1 mineral fiber insulation.
- .2 Fire Performance: ASTM E136 and CAN4 S114, non-combustible.
- .3 Fire Performance, Surface Burning Characteristics: ASTM E84 (UL 723) and CAN/ULC S102, flame spread 0 and smoke developed 0.
- .4 Water Vapor Transmission: ASTM E96: 27.2 to 33.1 perms (1555 to 1895 mg Pa.s.m2).
- .5 Moisture Resistance: ASTM C1104, moisture sorption of: 0.03 to 0.07percent
- .6 Thermal Resistance to ASTM C518 (C177),
  - .1 R-value of 4.2 to 4.3 per inch at 75 degrees F (RSI value 0.74 to 0.76 m m2K/W at 24 degrees C).
- .7 Corrosive Resistance: ASTM C665, Corrosiveness to Steel - Pass, ASTM C795, Stainless Steel Stress Corrosion Specification as per Test Methods C871 and C692.
- .8 Density to ASTM C612, from 3.4 to 6.2 lbs/ft3 (70 kg/m3)
- .9 Thickness: as indicated on drawings.
- .10 Dimensions: to suit application.
- .11 Acceptable material as required to suit thickness indicated:
  - .1 ‘CavityRock DD’ by Roxul Inc., or approved alternate.

2.2 ACCESSORIES

.1 Insulation Fasteners: mechanically driven insulation fasteners fabricated from high density polyethylene plastic, complete with zinc plated pin, holding diameter and fastener depth as recommended by manufacture to suit substrate, insulation type and thickness.
- .1 Acceptable product: ‘Ramset Insulfast Fastener’ by Ramset, ‘Grid-Mate PB Mechanical Fasteners’ by Grid-Mate, or approved alternate.

PART 3 – EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior

doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm / 3” from heat emitting devices such as recessed light fixtures, and minimum 50 mm / 2” from sidewalls of CAN4-S604 type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 type B and L vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been reviewed and accepted by Consultant.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Consultant in writing of defects.

.2 Prior to commencement of work ensure:

- .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 PERIMETER FOUNDATION INSULATION

.1 Exterior application: extend boards 152 mm / 6” minimum below finish grade to 1200 mm below grade. Install on exterior face of perimeter foundation wall with adhesive.

.2 Under slab application: extend boards below entire slab in location where indicated. Lay boards on level compacted fill.

3.5 SYSTEM RIGID INSULATION INSTALLATION

.1 Cavity Wall Insulation Installation in Exterior Wythe Masonry:

- .1 In locations with exterior wythe masonry, place insulation boards tightly between masonry ties. Secure in place with insulation fasteners, minimum 5 per 603 x 1220 mm board, locate one (1) at each corner at minimum 150 mm from edge each edge of board and one in center of board.

.2 Metal Roof System Insulation Installation in adjustable Z-Girt Locations over air / vapour barrier membrane:

- .1 Install first layer of insulation tight to air / vapour barrier using adhesive.
- .2 Using a notched trowel, trowel air/vapour barrier membrane adhesive in ribbon strips to back of insulation board as required, and as recommended by manufacture, for firm tight contact to air/vapour substrate.
- .3 Butter air/vapour barrier membrane adhesive around all board insulation edges to eliminate any potential air gaps between adjacent boards.
- .4 Install boards placed tightly together with no gaps between adjacent boards.
- .5 Install boards placed tightly with no gaps between back of insulation board and air / vapour membrane.

3.6 ROOF INSTALLATION

.1 Refer to Section 07410 – Preformed Metal Roofing

3.7 CLEANING

.1 Proceed in accordance with Section 01741 – Cleaning.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 – GENERAL

1.1 REFERENCES

.1 ASTM International Inc.

- .1 ASTM D412-06a (2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- .2 ASTM D882-12, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- .3 ASTM D903-98(2010), Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
- .4 ASTM D1004-09, Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
- .5 ASTM D1876-08, Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).
- .6 ASTM D1938-08, Standard Test Method for Tear-Propagation Resistance (Trouser Tear) of Plastic Film and Thin Sheeting by a Single-Tear Method.
- .7 ASTM E2357-11 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
- .8 ASTM D5147/D5147M-11a, Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
- .9 ASTM E154-08a, Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
- .10 ASTM E2178-11: Standard Test Method for Air Permeance of Building Materials.
- .11 ASTM E283-04(2012): Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .12 ASTM E1677-11 Specification for Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
- .13 ASTM E330-02(2010): Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- .14 ASTM E331-00(2009): Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- .15 ASTM E96/E96M-10, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Canadian Construction Documents Committee

- .1 CCDC 2-94, Stipulated Price Contract.

.3 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-19.13M-M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
- .2 CAN/CGSB-19.24M-M90, Multi-Component, Chemical Curing Sealing Compound.
- .3 CGSB 19-GP-14M-84, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .4 CGSB 37-GP-56M: Membrane, Modified, Bituminous, Prefabricated, and Reinforced.
- .5 CAN/CGSB 37.58-M86, Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing.

.4 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01330 - Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01330 - Submittal Procedures.

.3 Quality Assurance Submittals: submit following in accordance with Section 01430 - Quality Requirements.
- .1 Existing Substrate Condition: report deviations, as described in PART 3 -EXAMINATION in writing to Consultant.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
- .4 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.3 QUALITY ASSURANCE

.1 Submit in writing, a document stating that the applicator of the primary air/vapour barrier membranes specified in this section is recognized by the manufacturer as suitable for the execution of the Work.

.2 Perform Work in accordance with the manufacturer’s written instructions of the air/vapour barrier membrane and this specification.

.3 Maintain one copy of manufacturer‘s written instructions on site.

.4 Qualifications:
- .1 Applicator: company specializing in performing work of this section with minimum five (5) years documented experience with installation of air/vapour barrier systems.
  - .1 Completed installation must be approved by the material manufacturer.

.5 At the beginning of the Work and at all times during the execution of the Work, allow access to Work site by the air/vapour barrier membrane manufacturers' representative.

.6 Source components used in this section from one manufacturer, including sheet membrane, air/vapour barrier sealants, primers, mastics and adhesives.

.7 Mock-Up:
- .1 Construct mock-up in accordance with Section 01430 - Quality Requirements.
- .2 Construct typical exterior wall panel, incorporating window and door frames c/w jamb, sill and head conditions, insulation, building corner condition, junction with foundation wall and roof system(s) and other building conditions as directed by the Consultant; illustrating materials interface and seals.
- .3 Locate where directed.
- .4 Mock-up may remain as part of finished work to Consultant’s written approval.
- .5 Allow 72 hours for inspection of mock-up by Consultant before proceeding with air/vapour barrier Work.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

.3 Store role materials on end in original packaging.

.4 Keep solvent away from open flame or excessive heat.

.5 Protect rolls from direct sunlight until ready for use.

.6 Avoid spillage: immediately notify Consultant if spillage occurs and start clean up procedures.

.7 Clean spills and leave area as it was prior to spill.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Division 01.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

1.6 AMBIENT CONDITIONS

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Ventilate enclosed spaces in accordance with Section 01510 - Temporary Utilities.

.3 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.7 SEQUENCING

.1 Sequence work in accordance with Section 01320 - Construction Progress Documentation.

.2 Sequence work to permit installation of materials in conjunction with related materials and seals.

1.8 WARRANTY

.1 Provide manufacture’s five (5) year warranty under provisions of Section 01780 - Closeout Submittals and in accordance with General Conditions (GC) CCDC 2 GC 12.3 as amended through the Supplementary Conditions, if applicable.

.2 Warranty: include coverage of installed sealant and sheet materials which:

- .1 Fail to achieve air tight and watertight seal.
- .2 Exhibit loss of adhesion or cohesion.
- .3 Do not cure.

PART 2 – PRODUCTS

2.1 AIR/VAPOUR BARRIER SYSTEMS

.1 Obtain air/vapour barrier membrane components and accessories as a single-source from the

membrane manufacturer to ensure total system compatibility and integrity.

2.2 AIR/VAPOUR BARRIER FLUID (SPRAY) – APPLIED

.1 Fluid (Spray) Applied Air / Vapour Barrier Membrane

.1 For temperatures above 4º C: one component elastomeric bitumen, spray applied to a wet film thickness of 3 mm and having the following characteristics:

.1 Solids By Weight: 55%.
.2 Air permeability: 0.0006 L/s·m² @ 75 Pa., tested to ASTM E2178.
.3 Application Temperature: 4º C minimum.
.4 Tested to ASTM E2357 for Air Leakage of Air Barrier Assemblies
.5 Water Vapour Permeance: 5.0 ng/Pa.m^2.s., (ASTM E96).
.6 Tensile Strength (ASTM D412): 820 kPa.
.7 Elongation (ASTM D412): 800%.
.8 Recovery (CAN/CGSB 37.58): 90%.
.9 Nail Sealability (ASTM D1970): Pass.
.10 Resistance to Mold, Mildew & Fungal Growth (ASTM D5590): 0; No Growth.
.11 Colour: Beige.
.12 Acceptable Material: 'Air-Bloc 32MR' by Henry, or 'Sopraseal LM 203' by Soprema, or approved alternate.

.2 For temperatures above -12º C: one component elastomeric bitumen, spray applied to a wet film thickness of 2.2 mm and having the following characteristics:

.1 Solids By Weight: 62%.
.2 Air permeability: 0.002 L/s·m² @ 75 Pa., tested to ASTM E2178.
.3 Application Temperature: -12 deg C (10.4 deg F) minimum.
.4 Tested to ASTM E2357 for Air Leakage of Air Barrier Assemblies
.5 Water Vapour Permeance: 2.8 ng/Pa.m2.s., (0.05 perms) (ASTM E96).
.6 Tensile Strength (ASTM D412): 480 kPa.
.7 Elongation (ASTM D412): 1200%.
.8 Recovery (CAN/CGSB 37.58): 75%.
.9 Nail Sealability (ASTM D1970): Pass.
.10 Colour: Black.
.11 Acceptable Material: 'Air-Bloc 06' by Henry, or approved alternate.

2.3 TRANSITION SHEET MEMBRANE

.1 Transition Sheet:

.1 Thickness: 1.0 mm / 40 mils,
.2 Air leakage: <0.005 L/s.m² @ 75 Pa to ASTM E283-91,
.3 Tested to ASTM E 2357 for the air barrier assembly,
.4 Water vapour permeance: 1.6 ng/Pa.m².s / 0.03 perms to ASTM E96,
.5 Low temperature flexibility: -30 °C to CGSB 37-GP-56M,
.6 Elongation: 200% to ASTM D412-modifed.
.7 Acceptable product: 'Blueskin SA', by Henry or 'Sopraseal 60', by Soprema, or approved alternate.

1.1 TORCH GRADE AIR/ VAPOUR BARRIER SHEET MEMBRANE

.1 Primary sheet air/vapour barrier shall be, a SBS modified bitumen, reinforced thermofusible membrane having the following physical properties:

.1 Thickness: 2.5 mm / 100 mils min.
.2 Air leakage: 0.000 L/s.m² @ 75 Pa.

.3 Vapour permeance: 0.2 ng/Pa.m².s, (0.003 perms).
.4 Low temperature flexibility: -15°C to CGSB 37-GP-56M.
.5 Elongation: 40% md, 40% xd.
.6 Acceptable Product: ‘Blueskin TG’ as manufactured by Henry Company Canada, or ’Sopraseal 60 F/F’ by Soprema, or approved alternate.

2.4 THRU WALL FLASHING MEMBRANE

.1 Thru Wall Flashing Membrane:
.1 Rubberized reinforced asphalt compound, self-adhered membrane, width to suite application.
.2 Thickness: 1.0 mm / 40 mils,
.3 Puncture Resistance - Membrane to ASTM E154: 180N minimum / 40 lbf.
.4 Tear resistance: 200N /13 lbs. MD, to ASTM D1004,
.5 Tested to ASTM E 2357 for the air barrier assembly,
.6 Water vapour permeance: 1.6 ng/Pa.m².s / 0.03 perms to ASTM E96 Method B,
.7 Low temperature flexibility: -30 °C to CGSB 37-GP-56M,
.8 Lap Peel Strength at -4°C. to (ASTM D1876): 8.75N/cm / 5 lbf/in width.
.9 Adhesion to Concrete to ASTM D903: 8.75N/cm / 5.0 lb/in. width
.10 Elongation: 200% to ASTM D412-modifed.
.11 Acceptable Product: "Blueskin TWF" by Henry, or ‘Sopraseal WFM’ by Soprema, or approved alternate.

2.5 PRIMERS AND ADHESIVES

.1 Solvent based Adhesives and Primers: as recommended by air / vapour manufacturer to suit application.

2.6 SEALANTS

.1 Sealants in accordance with Section 07900 - Joint Sealants unless otherwise indicated.

.2 Termination Sealant in exposed locations: a sealing compound having the following physical properties:
.1 Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
.2 Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
.3 Complies with ASTM C 920, Type S, Grade NS, Class 25,
.4 Elongation: 450 – 550%,
.5 Remains flexible with aging,
.6 Seals construction joints up to 25 mm / 1” wide.
.7 Colour: as later selected by Consultant from manufacture’s standard colour range.
.8 Acceptable material: ‘HE925 BES Sealant’ manufactured by Henry, or ‘Sopramastic ALU’ by Soprema, or approved alternate.

.3 Termination Sealant in locations concealed from UV exposure: a sealing compound having the following characteristics:
.1 Compatible with sheet waterproofing membrane and substrate.
.2 Solids by volume: 70%,
.3 Vapour permeance: 2.9 ng/Pa.m².s, ASTM E96,
.4 Complies with CGSB 37.29,

.5 Remains flexible with ageing,
.6 Ahears to wet surfaces,
.7 Chemical resistance: Alkalis, calcium chloride, mild acid and salt solutions.
.8 Colour: black.
.9 Acceptable material: ‘Polybitume 570-05’ Polymer Modified Sealing Compound manufactured by Henry, or ‘Sopramastic’ by Soprema, or approved alternate.

2.7 ACCESSORIES

.1 Joint Treatment Mesh: Open weave glass fabric yarn saturated with synthetic resins.
.1 Acceptable Product: 990-06 Yellow Jacket by Henry Company, or approved alternate.

.2 Thinner and cleaner for Butyl Neoprene Sheet: as recommended by sheet material manufacturer.

.3 Attachments: galvanized steel bars and anchors, as recommended by membrane manufacturer.

PART 3 – EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GENERAL

.1 Perform Work in accordance with Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification requirements for materials and installation.

.2 Perform Work in accordance with National Air Barrier Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

.3 Perform Work in accordance with Canadian Urethane Foam Contractor's Association - Professional Contractor Quality Assurance Program and requirements for materials and installation.

3.3 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept work of this section.

.2 Ensure surfaces are clean, dry, sound, smooth, continuous and comply with air barrier manufacturer's requirements.

.3 Report unsatisfactory conditions Consultant in writing.

.4 Do not start work until deficiencies have been corrected.
.1 Beginning of Work implies acceptance of conditions.

3.4 PREPARATION

.1 Remove loose or foreign matter, which might impair adhesion of materials.

.2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled;

and concrete surfaces free of large voids, spalled areas or sharp protrusions.

.3 Ensure substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive adhesive and sealants in accordance with manufacturer's instructions.

3.5 AIR/VAPOUR BARRIER VOID COVERINGS

.1 Examine substrates of Work from other trades that are to receive air/ vapour barrier membranes. Cover all continuous gaps and voids as follows:

.2 Non-Moving Substrate Joint and Crack Treatment:
- .1 Gaps up to 6mm / 1/4” wide:
  - .1 Sealant Method: Apply building envelope sealant into the joint and strike smooth. Allow to dry prior to application of fluid applied air/vapour barrier membrane.
  - .2 Fluid-Applied Method: Apply a trowel application of fluid applied air/vapour barrier membrane, extending 75mm / 3” onto face of substrate. Reinforce with 50mm / 2” wide strip of joint treatment mesh, centered over joint, prior to application of fluid applied air/vapour barrier membrane.
  - .3 Self-adhered Sheet Method: Apply adhesive and allow to dry. Apply self-adhering sheathing joint / termination membrane and roll in place.
- .2 Gaps Between 6mm / 1/4” and 13 mm 1/2"wide:
  - .1 Sealant Method: Apply building envelope sealant into the joint and strike smooth. Allow to dry prior to application of fluid applied air/vapour barrier membrane.
  - .2 Self-adhered Sheet Method: Apply adhesive and allow to dry. Apply self-adhering sheathing joint / termination membrane and roll in place.
- .3 Gaps exceeding 13 mm / 1/2” in width: cover with prefinished sheet steel securely anchored to substrates in accordance with Section 07 62 00 – Sheet Metal Flashing and Trim.

.3 Examples of gaps and voids required to be covered are, but not limited to:
- .1 Control joints.
- .2 Expansion joints.
- .3 Gaps between dissimilar materials.
- .4 Gaps resulting from structural steel erection.
- .5 Other similar gaps and voids.

3.6 SELF-ADHERED SHEET MEMBRANE

.1 Adhesive or Primer for Transition and Through-wall Flashing Membrane (Self-Adhering)
- .1 Apply adhesive or primer for self-adhering membranes at rate recommended by manufacturer.
- .2 Apply to all areas to receive air / vapour barrier membrane, transition sheet and through-wall flashing membrane, as indicated on drawings by roller or spray and allow minimum 30 minute open time. Surfaces not covered by self-adhering transition membrane or self-adhering through-wall flashing membrane during the same working day must be re-applied.

.2 Transition Membrane (Self-Adhering)

.1 Apply transition sheet membrane to prepared surfaces as indicated.

.2 Apply transition sheet membrane over all adjoining dissimilar substrate materials such as but not limited to connections of existing masonry block to steel or concrete; drywall or plywood to steel or concrete and all beams, columns, window and door frames etc. using strips as required, lapped a minimum of 75 mm / 3" on both substrates and centered over joint.

.3 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 50 mm / 2” overlap at all end and side laps.

.4 Tie-in to window frames, aluminum screens, hollow metal doorframes, spandrel panels, roofing system and at the interface of dissimilar materials as indicated on drawings.

.5 Promptly roll all laps and membrane with a counter top roller to effect seal.

.6 Ensure all preparatory work is complete prior to applying liquid applied air / vapour barrier membrane.

.3 Through-wall Flashing Membrane (Self-Adhering)

.1 Apply through-wall flashing in accordance with CSA A371-94 Masonry Construction for Buildings; along the base of masonry veneer walls, over windows, doors and other wall openings required to be protected.

.2 Form flashing membrane applications continuous and extend up back-up wall a minimum 200 mm / 8”. Trim all overhanging material.

.3 At the end of each days work seal the top edge of the membrane where it meets the substrate using liquid air seal mastic. Trowel apply a feathered edge to seal termination and shed water.

.4 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. At locations where flashing terminates or intersects wall openings including door frames, “end dam” flashing to protect openings and redirect water out. Trim off excess material to Consultant approval.

.5 Align and position the leading edge of self-adhering through-wall flashing membrane with the front horizontal edge of the foundation walls, self angles and other substrates to be protected, partially remove protective film and roll membrane over surface and up vertically.

.6 Press firmly into place. Ensure minimum 50 mm / 2” overlap at all end and side laps. Promptly roll all laps and membrane to a positive seal.

.7 Ensure all preparatory work is complete prior to applying self-adhering through-wall flashing membrane.

.8 Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. Trim off excess to Consultant approval.

3.7 AIR/VAPOUR BARRIER FLUID (SPRAY) – APPLIED

.1 Fluid (Spray) Applied Air / Vapour Barrier Membrane:

.1 When flashing and transition membranes are installed and complete, apply fluid applied air / vapour barrier membrane complete and continuous over the entire wall surface as indicated, at a wet film thickness as indicated and as recommended by manufacturer, whichever is more stringent.

.2 Apply in continuous, monolithic application without sags, runs or voids, transitioning onto flashing membrane a minimum of 25 mm / 1”, to create uniform drainage plane and air / vapour barrier.

.3 Spray apply around all projections ensuring a complete and continuous coating.

.4 Allow fluid applied air/vapour barrier membrane to fully cure prior to placement of insulation.

3.8 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.9 CLEANING

.1 Proceed in accordance with Section 01740- Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.10 PROTECTION OF WORK

.1 Protect finished work.

.2 Do not permit adjacent work to damage work of this section.

.3 Ensure finished work is protected from climatic conditions.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

1.2 WORK INCLUDED

.1 The work of this Section, includes the provision of all labour, materials, equipment and services required to fabricate and install a preformed metal roofing system, complete with clips, perimeter and penetration flashing, and closures, as indicated on the drawings, as specified herein and as required for a complete project.

.2 The work includes all components for a complete system including matching fascia, flashings and trim.

1.3 RELATED REQUIREMENTS

.1 Section 05300 – Metal Decking.

.2 Section 06100 - Rough Carpentry.

.3 Section 07270 – Air/Vapour Barriers.

.4 Section 07620 – Sheet Metal Flashing and Trim.

1.4 REFERENCES

.1 American Architectural Manufacturers Association (AAMA):
  .1 AAMA 501.1 Standard Test Method for Metal Curtain Walls for Water Penetration using Dynamic Pressure.

.2 American Society of Civil Engineers (ASCE):
  .1 ASCE 7-98 Minimum Design Loads for Buildings and Other Structures.

.3 American Society for Testing and Materials International, (ASTM):
  .1 ASTM A792/A792M-03 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  .2 ASTM D1056-00 Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
  .3 ASTM D3575-00e1 Standard Test Methods for Flexible Cellular Materials Made from Olefin Polymers.
  .4 ASTM E1592-01 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems, by Uniform Static Air Pressure Difference.
  .5 E1646-95 (2003), Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems, by Uniform Static Air Pressure Difference.
  .6 E1680-95 (2003), Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.

.4 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  .1 1993 Ed., Architectural Sheet Metal Manual, 5th Edition.

.5 Factory Mutual Research (FM):

.1 FM 4471, Approval Standard for Class 1 Panel Roofs.

1.5 SUBMITTALS

.1 General: Submit each item in this Article according to the Conditions of the Contract and the applicable Division 1, Specifications Section.

.2 Shop Drawings:

.1 Show roofing system with flashings and accessories in plan, sections and details. Include metal thickness' and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations; thermal expansion provisions and special supports.

.2 Indicate relationships with adjacent and interfacing work. Indicate fastener types and spacing and provide fastener pullout values.

.3 Shop drawings must be completed by the metal panel manufacturer's engineering department.

.3 Product Data: Include manufacturer's detailed material and system description, sealant and closure installation instructions, engineering performance data and finish specifications. Indicate fastener types and spacing and required fastener pullout values.

.4 Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-98, Method 2 for Components and Cladding, signed and sealed by a professional engineer licensed to practice in the Province of Ontario and employed by the system manufacturer as a full-time staff engineer. In no case shall the design loads be taken to be less than those specifications herein.

.5 Design Test Reports: Provide certified test reports from an independent testing laboratory that bear the seal of a registered professional engineer to show compliance with the performance criteria specified herein. Each of the following test reports must be submitted:

.1 ASTM E1592: Test results must clearly demonstrate compliance with the following requirements:

.1 The ultimate test failure load shall be reduced by the specified safety factor to determine the allowable working load for the panel system.

.2 The proposed system has been tested to insure that the allowable working load of the panel system meets or exceeds the specified negative wind uplift pressures for all roof zones.

.3 The test results are applicable for the panel material, grade, thickness, width, and profile specified. Results are not applicable for systems that are thinner, wider, lower grade, or different material/profile than the system which was tested.

.4 The results must clearly show that the allowable clip spacing meets or exceeds the requirements specified in PART 3 for all roof areas. Clip spacing shall not be reduced for any roof zone from that which is specified.

.2 ASTM E1646 and E1680: Test results must clearly demonstrate compliance with the specified performance requirements. Results are not applicable for systems that are thinner, wider, lower grade, or different material/profile than the system which was tested. The differential test pressures must be equal to those specified.

.6 Samples: Provide full-scale samples of the following materials and system components. Samples shall be of identical material type, thickness, panel width, and material grade/alloy/temper as the system specified for this project. Except for Item 2, samples may be of any of the manufacturer's standard colours.

.1 Submit a 300 mm long actual width sample of panel showing seam profile and stiffening mesas across the flat pan of the panel. Also include separate snap-on cap with factory-applied hot melt sealant beads.

.2 Provide a 150 mm x 150 mm sample of the colour selected for this project. The sample shall be

the actual specified coating system on the specified metal substrate.

.3 Provide samples of actual system components, including: each type of anchor/clip required, head closure assembly, roll goods, bearing plates and/or framing.

1.6 QUALITY ASSURANCE

.1 Engage an experienced metal roofing contractor (installer) to install standing seam system who has a minimum of three (3) years experience specializing in the installation of structural standing seam metal roof systems.

.2 The Trade Contractor must be certified by manufacturer specified as a supplier of the structural standing seam system and shall obtain written certification from the manufacturer that installer is approved for installation of the specified system. If requested, the Trade Contractor must supply the Owner with a copy of this certification.

.3 The successful Trade Contractor is required to maintain a full-time supervisor/foreman who is on the job site at all times during installation of new roof system. The foreman must have a minimum of five (5) years experience with the installation of systems similar to that specified.

.4 Obtain all components of roof system from a single manufacturer including roll good materials. Any secondary products that are required which cannot be supplied by the metal roofing manufacturer must be recommended and approved in writing by the metal roofing manufacturer prior to bidding.

.5 If required, the installer shall submit work experience and evidence of adequate financial responsibility. The Consultant reserves the right to inspect fabrication facilities in determining qualifications.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Manufacturer's responsibility:

.1 Protect components during fabrication and packing from mechanical abuse, stains, discoloration, and corrosion.

.2 Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipment, storage, and handling.

.2 Installer's responsibility:

.1 Store materials off ground providing for drainage; under cover providing for air circulation and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.

.2 Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from the site.

.3 Protect panels from wind-related damages.

.4 Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

.5 Protective film on roof panels must be removed in a period of time which allows for FULL removal of all film. If any film residue remains on panels, it is the installer's responsibility to properly clean and remove residue at Owner's request.

.6 Be advised that cure time may vary based on environmental conditions.

1.8 JOB CONDITIONS

.1 Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal roofing system.

.2 Protection:
- .1 Provide protection or avoid traffic on completed roof surfaces.
- .2 Do not overload roof with stored materials.
- .3 Support no roof-mounted equipment directly on roofing system.

.3 Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof is in place and approved prior to installation of roofing.

1.9 DESIGN AND PERFORMANCE CRITERIA

.1 Thermal Expansion and Contraction:
- .1 Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
- .2 The design temperature differential shall be not less than 90°C.
- .3 Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
- .4 Location of metal roofing rigid connector shall be at roof ridge, unless otherwise approved by the
- .5 Consultant. Metal ridge connector may require design by the manufacturer to suit job conditions.

.2 Uniform Wind Uplift Load Capacity:
- .1 Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as spacing specified in Part 3.
  - .1 Design Code: ASCE 7-98, Method 2 for Components and Cladding.
  - .2 Safety Factor: 1.65 after any load reduction or material stress increase.
  - .3 Category III Building with an Importance Factor of 1.15.
  - .4 Wind Speed: 144 kph.
  - .5 Ultimate Pullout Value: 204 kg per each of the two (2) fasteners holding the panel anchor to the roof decking or framing system.
  - .6 Exposure Category: B.
  - .7 Design Roof Height: 4.5 m.
  - .8 Minimum Building Width: 7.6 m.
  - .9 Roof Pitch: 1:12
  - .10 Topographic Factor: 1.0.

Roof Area	Design Uplift Pressure
Zone 1 – Field of Roof	0.207 kPa
Zone 2 – Eaves	2.259 kPa
Zone 3 – Corners	2.259 kPa

- .2 Capacity shall be determined using pleated airbag method in accordance with ASTM E 1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above. In order to comply with the building code, panel system must be tested to withstand these listed pressures at clip spacings no closer than those specified in Part 3.

.3 Uniform Positive Load Capacity:

.1 The installed roof system shall be capable of resisting the following positive uniform roof loads: Roof Live Load of 0.958 kPa; Roof Snow Load of 0.958 kPa.

.2 Capacity to resist positive loads shall be determined by empirical calculations in accordance with AISI. Calculation shall be sealed by a registered professional engineer.

.3 Installed roof system shall carry positive uniform design loads with a maximum system deflection of L/180 as measured at the rib (web) of the panel.

.4 ASTM E1680: Static Pressure Air Infiltration (roof panels):

Pressure	Leakage Rate
0.075kPa	360 cm^3/m^2
2.039 kPa	30 cm^3/m^2
6.535 kPa	330 cm^3/m^2

.5 ASTM E1646: Static pressure water infiltration (roof panels):

Pressure	Leakage Rate
204 L/hr/ m^2 and Static Pressure	No Leakage of 6.535 kPa for 15-minutes.

.6 Water penetration (dynamic pressure): No water penetration, other than condensation, when exposed to dynamic rain and 112 kph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.

.7 Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range are not acceptable.

1.10 WARRANTIES

.1 Provide a 2-year warranty covering the roof system installation and water tightness.

.2 Provide a warranty from the manufacturer of the roof panels covering all of the following criteria; multiple warranties are not acceptable:

.1 Manufacturer's 30-year watertight warranty, including coverage for all trim, flashings, and penetrations associated with the standing seam roof area.

.2 Twenty (20) year coverage on finish including checking, crazing, peeling, chalking, fading and/or adhesion.

.3 Warranty shall commence on date of substantial performance.

.4 One manufacturer shall provide a single warranty for standing seam roof areas, membrane roof areas, and transitions between the two (2) material types.

1.11 DESCRIPTION METAL CLADDING SYSTEMS

.1 Provide the following sheet metal roof cladding system (from exterior to interior):

.1 Metal Roof Cladding System:

.1 Preformed metal roof cladding.

.2 Ice and water shield

.3 Pressure treated plywood

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 This specification is based on the R-MER Span System standing seam metal roofing by Garland Canada Inc.

.2 Acceptance of products by other manufacturers is subject to the approval of the Consultant.

.3 Standing seam roof and snow retention system to be provided by the same manufacturer.

2.2 STANDING SEAM ROOFING SYSTEM

.1 Materials:
- .1 Panel material: 0.61 mm thick (24 ga) Galvalume steel, Type AZ55, smooth, in accordance with ASTM A792.
  - .1 Flashing and flat stock material: Fabricate in profiles indicated on drawings of same material, thickness, and finish as roof system, unless indicated otherwise.

.2 Finish on Surfaces:
- .1 Exposed surfaces for coated panels:
  - .1 Two coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
  - .2 Coating system shall provide nominal 0.025 mm dry film thickness, consisting of primer and colour coat.
  - .3 Colour choice will be selected by Consultant at a later date from the manufacturer's standard colour range.
- .2 Unexposed surfaces for coated panels shall be baked-on polyester coating with 0.005 mm to 0.008 mm dry film thickness (DFT).

.3 Characteristics:
- .1 Provide the same panel profile from a single manufacturer for all standing seam roof areas.
- .2 Provide standing seam panels incorporating mechanically interlocked, concealed anchor clips allowing unlimited thermal movement, and of configuration which will prevent entrance or passage of water.
  - .1 Panel/Cap configuration must have a total of four (4) layers of steel surrounding anchor clip for prevention of water infiltration and increased system strength designed to limit potential for panel blow-off.
  - .2 Profile of panel shall have mesa's every 50 mm o.c., continuous throughout panel which are a minimum of 38 mm wide.
  - .3 Exposed fasteners, screws and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at panel overlap and trim details in accordance with the manufacturer's guidelines.
  - .4 Provide panels in continuous lengths from eave to eave with no overlaps unless approved by manufacturer, in writing.
  - .5 Panels lengths which exceed maximum shipping lengths shall be field rolled on equipment owned by the panel manufacturer. Seam sealant must be factory applied.
  - .6 Seam caps shall be manufactured in the factory and may be installed with endlaps. Seam sealant must be factory applied.
- .3 Seam must be 60 mm minimum height. Seam shall have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow unlimited expansion and contraction of panels due to thermal changes. Integral (not mechanically sealed) seams are unacceptable.
- .4 Concealed Standard Anchor Clips: Clips must be sixteen (16) 1.52 mm (16 ga) Galvalume steel, one-piece clip with projecting legs for additional panel alignment and provision for unlimited

thermal movement in each direction along the longitudinal dimension.

.1 Two-piece clips are unacceptable.

.2 Sealant applied in panel cap must be isolated from clip to insure that no sealant damage occurs from the movement of the panel during expansion and contraction.

.3 Clip must maintain a clearance of a minimum of 10 mm between panel and substrate for proper ventilation to help prevent condensation on underside of panel and eliminate the contact of panel fastener head to panel.

.5 Seam Cap: Snap-on cap shall be a minimum of 25 mm wide “T” shaped of continuous length up to 13.7 m according to job conditions and field seamed by means of manufacturer’s standard seaming machine.

.1 Cap shall be designed to receive two (2) beads of continuous hot applied gasketing sealant which will be applied independent of anchor clip to allow unlimited thermal movement of panel without damage to cap sealant.

.2 Sealant shall be a SIS (Styrene- Isoprene-Styrene) block copolymer type thermoplastic rubber adhesive, non-fatigue water barrier.

.6 Standing Seam Panel Width: 457 mm.

.7 Stiffening ribs: Located in flat of panel to minimize oil canning and telegraphing of structural members.

.8 Replaceability: Panels shall be of a symmetrical design with snap-on cap configuration such that individual panels may be removable for replacement without removing adjacent panels.

.9 Panel ends shall be panned at ridge, headwall, and hip conditions, or where applicable.

.10 Panel length: Full length without joints, including bends.

.4 Site Formed Panels: Panels in excess of shippable length shall be formed on-site. Site formed panels shall meet each of the following requirements:

.1 Panels shall be formed on heavy-duty factory type rollformers. Rollformers shall gradually form the panel profile utilizing no fewer than twelve (12) forming stations to improve quality and minimize oil canning.

.2 All tooling shall be polished and tempered to a minimum hardness of Rockwell C-52. Tooling shall be maintained clean and in good working condition. Tooling repairs or modifications made by means of welding, sawing, grinding or the like are unacceptable, as they may contribute to poor quality, aesthetics, and performance of the end product.

.3 Panels shall be of identical profile and characteristics as factory formed panels and specimens used as the basis of performance tests.

.4 Sealant shall be factory applied in a separate factory formed snap-on cap. Site/field applied seam sealant is unacceptable. Seam caps may be shipped in 45' or less length and lap spliced over full-length panels in accordance with manufacturer’s system details.

.5 Site rollforming equipment shall be operated by a trained full-time experienced technician. The installer must provide additional personnel to handle raw materials and finished product, as necessary.

.5 Accessories:

.1 Gable anchor clips for:

.1 Standing Seam style.

.2 Galvalume steel, type AZ-55, minimum thickness 1.52 mm (16 ga).

.2 Fasteners:

.1 Concealed fasteners: Corrosion resistant steel fasteners (zinc plated, stainless steel or equal) designed to meet structural loading requirements. Provide ¼ - 14 3 pt., as the minimum fastener size.

.2 Exposed fasteners: Series 410 stainless steel fasteners or one-eighth 3 mm diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the colour of the standing seam panels.

.3 Closures: Factory precut closed cell foam meeting ASTM D1056 or ASTM D3575, enclosed in metal channel matching panels when used at hip, ridge, rake, and jamb.

.4 Provide all miscellaneous accessories for complete installation.

.6 Snow and Ice Retention System:

.1 Roof Attachment Clamps: Provide aluminum standing seam roof clamp. Carbon steel or plastic parts are not acceptable. No fastener penetrations of the roof membrane will be permitted. No systems that rely on adhesives for attachment will be permitted. Clamp to attach to the standing seam will have two stainless steel set screws.

.2 All loads incurred by the snow and ice retention system will be transferred to the panels via standing seams; therefore proper panel attachment to substrate/structure is necessary to prevent roof panels from sliding under snow load.

.3 Submit manufacturer's specifications with drawings indicating type of preformed brackets, thicknesses of metal components, size, spacing and location of supports, connections, type of fastenings and installation instructions.

.4 Acceptable Product: S-5 by Garland or approved alternate.

2.3 ACCESSORY PRODUCTS

.1 Sealant:

.1 Acceptable Product:

.1 Concealed Application: Non-curing butyl sealant.

.2 Exposed Application: Standard of acceptance: Garland SS sealant.

.3 Colours: As selected by Architect from sealant manufacturer’s standard selection.

.2 Sheet Seal Self Adhesive: Rubberized asphalt bonded to sheet polyethylene or scrim reinforced modified bitumen, nominal total thickness of 1-1.5 mm.

.1 Acceptable manufacturers: Bakor, Meadows or W.R. Grace.

.3 Insulation:

.1 Refer to Section 07212 – Board Insulation.

.4 Bearing Plates:

.1 Install bearing plates directly over rigid board insulation/underlayment at each anchor clip location.

.2 Bearing plates shall be 76 mm x 127 mm x 1.52 mm (16 ga), minimum galvanized steel.

.3 Bearing plates shall be pre-punched with a hole pattern matching that of the panel anchor clips. Slotted holes are acceptable.

.5 Steel Framing:

.1 Install 150 mm high by 1.9 mm (14 ga) galvanized steel z-girts to the roof deck. Install z-girts perpendicular to panel seams, and space as required, to accommodate the specified panel anchor.

.6 Breathable Water Barrier:

.1 Acceptable product: Protec by Tyvek or approved alternate.

.7 Fiberglass Faced Gypsum board Substrate:

.1 Refer to Section 09210 – Gypsum Board Assemblies.

2.4 FABRICATION

.1 Shop fabricate metal roofing and flashing components to the maximum extent possible, forming metal work with clear, sharp, straight, and uniform bends and rises. Hem exposed edges of flashings.

.2 Form flashing components from full single width sheet in minimum 3048 mm lengths. Provide mitered corners, joined using closed end pop rivets and joint sealant.

.3 Fabricate roofing and related sheet metal work in accord with approved shop drawings and applicable standards.

PART 3 – EXECUTION

3.1 PREPARATION

.1 Inspection: Examine the alignment and placement of the building structure and substrate. Correct any objectionable warp, waves or buckles in the substrate before proceeding with installation of the pre-formed metal roofing. The installed roof panels will follow the contour of the structure and may appear irregular, if not corrected.

.2 Establish straight side and crosswise benchmarks.

.3 Use proper size and length fastener for strength requirements. Approximately 8 mm, is allowable for maximum fastener head size beneath the panel.

.4 Rectangular shaped roofs shall be checked for square and straightness. Gable ends may require setting a true line for the gable clips and setting with string line.

.5 Measure the roof lengthwise to confirm panel lengths, overhangs, coverage of flashings at eaves and ridges and verify clearances for thermal movement.

.6 Pre-roofing conference: prior to beginning metal roofing work, a pre-roofing conference shall be held to review work to be accomplished. The following parties shall be present:

.1 Consultant
.2 Contractor
.3 Metal Roofing Subcontractor
.4 Metal Roofing System Manufacturer’s Representative
.5 All other subcontractors who have equipment penetrating roof or whose work involves access to roof.

3.2 METAL FABRICATION AND EQUIPMENT

.1 Mechanical panel fabrication for curving panels shall be operated by a trained full-time experienced technician.

.2 Mechanical equipment shall have at least 16 rolling stations and provide a product identical to factory manufactured product.

3.3 ROOFING AND FLASHING INSTALLATION

.1 Comply with all details and install roofing materials and flashings in accordance with approved shop drawings and manufacturer’s product data, within specified erection tolerances.

.2 Prepare roof for the installation of standing seam panels, including:

.1 Install all decking, framing, and/or furring members as indicated in this specification and bid documents.

.2 Install all insulation, vapour retarders, and/or air infiltration barriers as indicated in this specification and bid documents.

.3 Install all underlayments and/or temporary water proofing materials as required in this specification and bid documents.

.3 Directly over the completed roof substrate, install one (1) piece panel anchor clips. All anchor clips will be set on 1.52 mm (16 ga) galvanized pre-punched bearing plates to distribute the loads on the board insulation.

.1 Clip spacing must be 1524 mm for Zone 1 (field).

.2 Clip spacing must be 864 mm for Zone 2 (eave, ridge, hip and rake).

.3 Clip spacing must be 864 mm for Zone 3 (corners).

.4 Clip spacing for Zones 2 and 3 must extend 864 mm onto the roof area.

.4 Installation of Roof Panels: Roof panels can be installed by starting from either end and working towards the opposite end. Due to the symmetrical design of the specified panel system, it is also acceptable to start from the middle of the roof and work toward each end.

.1 A stainless steel pop rivet shall be secured through the anchor reveal of the panel leg and extend into the arms of the panel clip located at the ridge of the system. Provide at each arm of the clip along the ridge. The panel is then anchored at both sides of the clip.

.1 Be sure to capture all drilling debris during this operation with a rag or cloth placed on the panels at the drilling operation.

.2 Panels are not securely attached to the roof until fixed to the anchor clip. To avoid damage and injury, all panels shall be fixed to the anchor clip immediately, as they are installed.

.2 The seam caps are shipped with two (2) beads of factory applied hot melt sealant located inside the caps. To install the caps, hook one side of the cap over the panel edge and rotate over the opposite panel leg. For ease of installation, start at one end of the panel and work toward the opposite end.

.3 A hand crimping tool is used to crimp the cap around the top of two (2) adjacent panels.

.4 Caps shall then be permanently seamed with manufacturers mechanical seamer.

.5 At the end of each day's work, seam caps shall be mechanically seamed or hand crimped (crimp 100 mm every 2400 mm to reduce the possibility of wind damage) prior to completion of the project.

.6 Un-installed panels which are temporarily stored on the ground or roof shall be secured in place at the end of each day's work to prevent possible damage or injury.

.5 Isolate dissimilar metals and masonry or concrete form metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.

.6 Limit exposed fasteners to extent indicated on shop drawings.

.7 Anchorage shall allow for temperature expansion/contraction movement without stress or elongation of panels, clips, or anchors. Attach clips to structural substrate using fasteners of size and spacing, as determined by manufacturer's design analysis, to resist specified uplift and thermal movement forces.

.8 Seal laps and joints in accordance with roofing system manufacturer's product data.

.9 Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with standards of SMACNA Manual.

.10 Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment in accordance with system manufacturer's product data and design calculations.

.11 Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is, therefore, not cause for rejection.

.12 Maximum variation from true planes or lines shall be one-fourth 6 mm in 6 m and 10 mm in 12 m or more.

.13 Form joints in linear sheet metal to allow for 6 mm minimum expansion at 6 m o.c. maximum and 2400 mm from corners.

.14 At joints in linear sheet metal items, set sheet metal items in two (2) 6 mm beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

.15 Remove damaged work and replace with new, undamaged components.

.16 Touch up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.

.17 Clean exposed surfaces of roofing and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 The Aluminum Association Inc. (AAI)
- .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
- .2 AAI DAF45-03, Designation System for Aluminum Finishes.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 167-992009, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .2 ASTM A 240/A 240M-12, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .3 ASTM A 606/A606M-09a, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
- .4 ASTM A 653/A 653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .5 ASTM A 792/A 792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .6 ASTM B 32-08, Standard Specification for Solder Metal.
- .7 ASTM B 370-11e1, Standard Specification for Copper Sheet and Strip for Building Construction.
- .8 ASTM D 523-2008, Standard Test Method for Specular Gloss.
- .9 ASTM D 822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canadian Roofing Contractors Association (CRCA)
- .1 Roofing Specifications Manual 1997.

.4 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .3 Canadian Standards Association (CSA International)
- .4 CSA A123.3-052010, Asphalt Saturated Organic Roofing Felt.
- .5 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.
- .6 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.5 Green Seal Environmental Standards
- .1 Standard GS-03-93, Anti-Corrosive Paints.
- .2 Standard GS-11-97, Architectural Paints.
- .3 Standard GS-36-00, Commercial Adhesives.

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01330 - Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01350 - Health and Safety Requirements and Section 01561 - Environmental Procedures.

.3 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01330 – Submittal Procedures.

.4 Samples:
.1 Submit duplicate 50 x 50 mm / 2” x 2” samples of each type of sheet metal material, finishes and colours.

.5 Quality assurance submittals: submit following in accordance with Section 01430 - Quality Requirements.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Division 01.

PART 2- PRODUCTS

2.1 PREFINISHING METAL FLASHINGS

.1 Prefinished Metal Flashing (Flat Stock): galvanized steel, minimum temper rolled accordance with ASTM A446, to profiles indicated, type, colour and thickness to match metal cladding. Factory applied silicone modified polyester finish shall be Series 5000 pre-coating by Dominion Foundries and Steel Limited or the Steel Company of Canada Limited.
.1 Class F1S.
.2 Prefinished ‘Standard’ and ‘Extended’ Colour Ranges series:
.1 Acceptable product ‘Colorite’ by Vicwest, or equivalent by Agway, or Ideal Roofing.

.2 Colours: to be selected by Consultant from manufacturer’s standard colour range.

.3 Coating thickness: not less than 20 micrometers.

.4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
.1 Outdoor exposure period 500 hours.
.2 Humidity resistance exposure period 500 hours.

.5 Prefinished Metal Sills, full length, of type and size and profile indicated, 0.76 mm / 22 gauge metal c/w drip, chairs, anchoring devices and end damns.

.6 Shape and Size: as detailed on drawings, with minimum 2% drainage slope to exterior.

2.2 ALUMINUM SILLS

.1 Aluminum sills, extruded aluminum, full length, of type and size and profile indicated including caps and end dams, 3.2mm / 0.125" thick anodized aluminum c/w drip, chairs, anchoring devices and end damns.

.2 Colour and finish of aluminum sills and aluminum flashing to match aluminum window frames and curtain wall frames.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Underlay for metal flashing: Underlay for metal flashing: Refer to Section 07 28 00 Air / Vapour Barriers, 'Through Wall Flashing Membrane'

.4 Sealants: Refer to Section 07 90 00 – Joint Sealants.

.5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.6 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.7 Washers: of same material as sheet metal, 1 mm / 0.039" thick with rubber packings.

.8 Touch-up paint: as recommended by prefinished material manufacturer.

2.4 FABRICATION

.1 Form flashings, copings and fascias to sizes and profiles indicated.

.2 Fabricate metal flashings, sills and other sheet metal work in accordance with applicable CRCA 'FL' series details as indicated.

.3 Fabricate aluminum flashings, sills and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.

.4 Form pieces in 2440 mm / 8'-0" minimum lengths.
  .1 Make allowance for expansion at joints.

.5 Form sills in full window width pieces, in profiles as indicated, c/w end caps and end damns. Round off all sharp edges within 2000mm off ground level.

.6 Hem exposed edges on underside 12 mm / 1/2".
  .1 Mitre and seal corners with sealant.

.7 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.8 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.5 REGLETS AND CAP FLASHINGS

.1 Form recessed, surface mounted reglets metal cap flashing to be built-in concrete masonry work for base flashings as detailed in accordance with CRCA FL series details.
  .1 Provide slotted fixing holes and steel/plastic washer fasteners.
  .2 Return open ends of metal flashings to cover voids. Ensure all sharp edges are rounded and made safe.

PART 3- EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install sheet metal work in accordance with CRCA FL series and as detailed.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal.
- .1 Secure in place and lap joints 100 mm / 4”.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.
- .1 Flash joints using S-lock forming tight fit over hook strips, as detailed.

.5 Lock end joints and caulk with sealant.

.6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

.7 Insert metal flashing into reglets under cap flashing to form weather tight junction.

.8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm / 1”. Lead wedge flashing securely into joint.

.9 Insert metal flashing under cap flashing to form weathertight junction.

.10 Caulk flashing at reglets and cap flashings with sealant. Do not seal where water is intended to drain from the building system / components.

.11 Install pans, where shown around items projecting through roof membrane.

3.3 SILL INSTALLATION

.1 Provide mock-up of window sill conditions where directed by Consultant. Do not proceed with installation of window sills until approved in writing by the Consultant. Allow 72 hours for inspection of mock-up by Consultant before proceeding with the work.

.2 Fabricate sills to suit individual window openings and to accommodate concealed end damns where possible to Consultant approval. Set sills with uniform design drainage slope to exterior, level in length. Where possible extend sills past jambs as required to conceal end damns behind adjacent exterior wall finish and provide watertight joint with sealant concealed from the elements.
- .1 At masonry locations fit sills to provide snug fit. Set end damns and against masonry in bed of sealant in accordance with Section 07900 – Joint Sealants and provide watertight joint concealed from the elements.

.3 Cut sills to fit 150 mm / 6” longer than window opening. Set sills with uniform design drainage slope to exterior, level in length. Extend sills past jambs and provide watertight joint concealed from the elements.

.4 Secure sills in place with anchoring devices located at ends and joints and evenly spaced at maximum 610 mm / 2’-0” maximum between.

.5 Provide one-piece sill flashing where practicable.
- .1 Where joints are required, keep joints to a minimum and locate to provide equal sill lengths. Provide a 200 mm / 8” long sill piece sill below window sill and embed exposed sill fully into bed of sealant over sill piece for a water tight connection. Do not surface caulk joints.

.6 Provide adequate space between butt ends of sill lengths to allow for thermal expansion. For sills over 1220 mm / 4’-0” in length, maintain 3 to 5 mm / 1/8” to 3/16” expansion space at each end. Provide securely fastened concealed flashing below exposed sill and make watertight with sealant concealed from the elements for longevity.

.7 Return and close exposed ends of sill flashings watertight complete with drip, angled and chamfered as required to eliminate all sharp edges.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
  .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 CLEANING

.1 Proceed in accordance with Section 01741 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
- .1 ASTM C834-10, Standard Specification for Latex Sealants.
- .2 ASTM C 919-12, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
- .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
- .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

.3 General Services Administration (GSA) - Federal Specifications (FS)
- .1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01330 - Submittal Procedures.

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's product to describe:
  - .1 Caulking compound.
  - .2 Primers.
  - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit two (2) copies of WHMIS MSDS in accordance with Section 01330 - Submittal Procedures.

.3 Samples:
- .1 Submit 2 samples of each type of material and colour.
- .2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions:
- .1 Submit instructions to include installation instructions for each product used.

1.3 QUALITY ASSURANCE

.1 Qualifications:
- .1 Subcontractor: Possess a copy of and be familiar with all standards specified. A person specializing in work specified with minimum five (5) years documented experience approved by Manufacturer.
- .2 Installer: A person specializing in installing sealants in exposed joints with minimum one (1) year documented experience approved by Manufacturer.

.2 Mock-ups:
- .1 Construct mock-up in accordance with Section 01430 - Quality Requirements.
- .2 Construct mock-up to show location, size, shape and depth of joint(s) complete with back up material, primer, caulking and sealant.
- .3 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed by Consultant.
- .5 Allow seventy-two (72) hours for inspection of mock-up by Consultant before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work if deemed acceptable by Consultant.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01780 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect joint sealants from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Ambient Conditions:
- .1 Proceed with installation of joint sealants only when:
  - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
  - .2 Joint substrates are dry.
  - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:
- .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:
- .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

.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) acceptable to Health Canada.

.2 Arrange for ventilation system to be operated on maximum outdoor air and exhaust during installation of caulking and sealants. Ventilate area of work as required with use of approved portable supply and exhaust fans.

1.8 WARRANTY

.1 Provide a written warrantee signed and issued in the name of the Owner, stating that caulking work of this section is guaranteed against leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion and staining adjacent surfaces, for a period of two (2) years from date of Consultant's Certificate of Substantial Performance.

PART 2- PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only primers as recommended by sealant manufacturer for type of surface and conditions being primed.

.4 Joint Filler and Back-Up: Circular cross section unless shown as slab or sheet, minimum 25% wider than joint, semi-rigid: closed cell polyethylene or polyurethane product, rubber tubing or non-migrating plasticized vinyl having a shore "A" hardness of 20 and tensile strength of 130-200 kPa, compatible with sealant and as recommended by sealant manufacturer.
- .1 Acceptable material: ‘Ethafoam’, by Dow Chemical of Canada Ltd, or product of Hercules Inc., Delaware USA.

.5 Bond Breaker: As recommended for use by sealant manufacturer.

.6 Vent Tubes: Rigid clear extruded plastic, min. 6 mm ID and 9 mm OD.

.7 Preformed compressible and non-compressible back-up materials:
- .1 Polyethylene, urethane, neoprene or vinyl foam:
  - .1 Extruded closed cell foam backer rod.
  - .2 Size: oversize 30 to 50 %.
- .2 Neoprene or butyl rubber:
  - .1 Round solid rod, Shore A hardness 70.
- .3 High density foam:
  - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
- .4 Bond breaker tape:
  - .1 Polyethylene bond breaker tape which will not bond to sealant.

.8 Sealant Colours: Colours of exposed sealants as later selected by Consultant from manufacturer’s standard colour range.

2.2 SEALANT MATERIAL / DESIGNATIONS

.1 Exterior Use:

.1 All areas unless specified otherwise: One Part moisture curing polyurethane, Self-Leveling to CAN/CGSB-19.13, class MC-2-25-B-N:
  .1 Acceptable Product: "Dymonic' by Tremco Ltd, or approved alternate.
.2 All areas unless specified otherwise: Multi-component, polyepoxide urethane sealant meeting CGSB specification CAN/CGSB-19.24-M90, Type 2, Class B:
  .1 Acceptable Product: 'Dymeric' by Tremco Ltd or approved alternate.
.3 Prefinished Metal to Prefinished Metal: one part blend of synthetic rubber and resin, self-leveling to CAN/CGSB 7.1:
  .1 Acceptable Product: "Gutter Seal" by Tremco or approved alternate.
.4 Glass to glass, glass to metal and metal to metal curtain wall joints: Medium modulus, moisture curing, one part silicone sealant. Meeting the specified requirements of specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-L:
  .1 Acceptable Product: 'Spectrem 2' by Tremco Ltd or approved alternate.
.5 Sealants in contact with air/ vapour barrier membranes: refer to Section 07270 Air / Vapour Barriers
.6 Exterior and interior horizontal traffic joints unless otherwise indicated: Multi-component or single component self leveling or slope grade polyurethane sealant. Meeting the specified requirements of ASTM C920, Type M, Grade P, Class 25, Use T, M, A and O:
  .1 Acceptable Product: 'THC 900', or 'THC 901 hybrid', or 'Vulkem 245', or Vulkem 45 polyurethane by Tremco Ltd or approved alternate.
.7 Exterior and interior horizontal traffic joints where slope of deck makes self leveling material impractical:
  .1 Acceptable Product: 'THC 901' by Tremco Ltd, or approved alternate.

.2 Interior Use:
.1 Lap Joints in Plastic Sheet Vapour Barrier and around mechanical piping and conduit in concealed to view spaces in partitions identified with an STC rating: Non-skinning, non-hardening, non-oxidizing, non-bleeding synthetic rubber sealant sealing and bedding compound for acoustical purposes and concealed joints conforming to CAN/CGSB 19-GP-21M87:
  .1 Acceptable Product: "Acoustical Sealant", by Tremco, or approved alternate.
.2 Joints around holes or voids made by through penetrations including but limited to mechanical piping and conduit in exposed to view spaces in partitions identified with an STC rating: easy gunning, non-staining, paintable acrylic polymer conforming to ASTM C834:
  .1 Acceptable Product: "Tremflex 834", by Tremco, or approved alternate.
.3 Interior General Application (all areas unless specified otherwise): to CAN/CGSB-19.14M:
  .1 Acceptable Product: "Tremflex 834" by Tremco or approved alternate.
.4 Wet Areas and Washroom Fixtures: Mildew resistant, one component neutral cure silicone sealant to CGSB-19GP22M:
  .1 Acceptable Product: "Tremsil 200" by Tremco or approved alternate.
.5 Interior non-moving joint applications to be painted: One component, paintable acrylic latex sealant to CGSB-19-GP-17M:
  .1 "Tremflex 834" by Tremco or approved alternate.
.6 Interior Fire Stop application:
  .1 All locations unless otherwise noted:
    .1 Acceptable Product: to CAN4-S115M "Tremstop Acrylic (GG)" by Tremco or approved alternate.
.7 Expansion Joints at:
  .1 Existing slab on grade:
    .1 Two-component, self-levelling, premium-grade, polyurethane-based, elastomeric sealant, capable of ± 50% joint movement.
      .1 Acceptable Product: 'Sikaflex 2c SL' by Sika, or approved alternate.
  .2 Vertical walls above & below grade and exterior cladding and at existing ground level and roof slab:

.1 Two-component, non-sag, premium-grade, polyurethane-based, elastomeric sealant, capable of ± 50% joint movement.
.1 Acceptable Product: 'Sikaflex 2c NS EZ Mix' by Sika, or approved alternate.

2.3 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

PART 3- EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate. Inform Consultant of unacceptable conditions immediately upon discovery.
.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

.1 Sealant:
- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:
- .1 Cure sealants in accordance with sealant manufacturer's instructions.
- .2 Do not cover up sealants until proper curing has taken place.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01741 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Clean adjacent surfaces immediately.
- .3 Remove excess and droppings, using recommended cleaners as work progresses.
- .4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01741 - Cleaning.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

3.9 SCHEDULE

.1 Apply sealant at the following exterior locations:
- .1 Between dissimilar materials in locations except where specifically indicated otherwise.
- .2 Control joints in masonry elements.
- .3 Joints between precast elements and between precast concrete elements and adjacent Work.
- .4 Below thresholds (double bead).
- .5 At perimeter of door, screen and louver frames.
- .6 At penetrations through exterior building elements.
- .7 Where indicated.

.2 Apply sealant at the following interior locations:
- .1 Between dissimilar materials in exposed locations except where specifically indicated otherwise.
- .2 Perimeter of exterior door, louver and screen frames.
- .3 Between interior door frames and wall.
- .4 Control joints in masonry elements, and joints between bearing and non-bearing masonry walls.
- .5 Building expansion joints, except where expansion joint covers are required.
- .6 At ceramic tile control joints.
- .7 Perimeter of firehose cabinets, access panels, and control panels.
- .8 Between vanities / countertops / u/s of window sills and walls.
- .9 Between interior door frame and flooring.

.10 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints.
.1 At locations required to have an STC rating, ensure continuity and integrity of sound ratings are maintained.
.11 Where shown.

.3 At interior locations use acrylic emulsion sealant except:
.1 At floor control joints use self-leveling polyurethane.
.2 At vanities / countertops and at ceramic wall tile control joints use silicone sealant.
.3 Where expected joint movement exceeds movement capacity of acrylic emulsion sealant, use sealant specified for exterior use, as directed by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 653/A 653M-11, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM B 29-03 (2009), Standard Specification for Refined Lead.
- .3 ASTM B 749-03 (2009), Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)
- .1 CSA-G40.20-04/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59-08 (R2009), Welded Steel Construction (Metal Arc Welding).
- .3 CSA A440-11, AAMA/WDMA/CSA 101/I.S.2/A440-11, North American Fenestration Standards/Specification for Windows, Doors and Skylights.
- .4 CSA A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440,NAFS # North American Fenestration Standard/Specification for windows, doors, and skylights, Includes Update No. 1 (2013).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)
- .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
- .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.

.5 National Fire Protection Association (NFPA)
- .1 NFPA 80-(2013 Edition), Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-(2012), Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .2 CAN/ULC-S702-09-AM1, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
- .3 CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
- .4 CAN/ULC4-S104-10, Standard Method for Fire Tests of Door Assemblies.
- .5 CAN4-S105-09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.2 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
- .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 NFPA 252 for ratings specified or indicated.
- .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E 152 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

.5 Fenestration performance grades for doors:
.1 In accordance with the CSA A440SI Canadian Supplement, Clause (1)(b) appropriate for the conditions and geographic location in which the doors will be installed.
.2 Conform to performance grades selected under CSA A440SI Canadian Supplement, Sentence (2) when tested in accordance with the standard referenced in Clause (1)(a).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01330 - Submittal Procedures.

.2 Provide product data: in accordance with Section 01330 - Submittal Procedures.

.3 Provide shop drawings: in accordance with Section 01330 - Submittal Procedures.
.1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and fire rating and finishes.
.2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing fire rating finishes.
.3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
.4 Submit test and engineering data, and installation instructions.
.5 Verify actual opening sizes and field conditions by field measurement before fabrication. Shop drawings to reflect measurements and conditions provided, and product shall be manufactured accordingly. Coordinate field measurements with fabrication and construction schedules to avoid delays.

.4 Provide samples in accordance with Section 01330 - Submittal Procedures.

.5 Submit one 305 x 305 mm / 12” x 12” corner sample of each type of frame.
.1 Show butt cutout glazing stops 305 mm / 12” long removable mullion connection snap-on trim with clips.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

.2 Storage and Handling Requirements:
.1 Store materials off floor, in well ventilated room, indoors in dry location and in accordance with manufacturer's recommendations in clean, dry area.
.2 Store and protect metal doors and frames from dents, nicks, scratches, and blemishes , well-ventilated area.
.3 Replace defective or damaged materials with new.

PART 2- PRODUCTS

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:
  .1 Structural small, 24.5 mm / 1” full, 32 mm / 1 1/4", cell size resin impregnated fibrous 'honeycomb'.

.2 Stiffened: face sheets laminated insulated core.
  .1 Insulation: Fibreglass to CAN/ULC-S702, semi-rigid, density 24 kg/mü.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Section 09900 - Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior and interior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Door bottom seal: Refer to Section 08710 - Door Hardware and door hardware schedule.

.5 Metallic paste filler: to manufacturer's standard.

.6 Fire labels: metal, riveted and clearly visible.

.7 Sealant: Refer to Section 07900 – Joint Sealants.

.8 Make provisions for glazing as indicated and provide necessary glazing stops.
  .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
  .2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.6 mm / 16 ga. welded thermally broken type construction.

.4 Interior frames:
.1 1.6 mm / 16 ga. welded type construction, unless otherwise indicated.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare frame for door silencers, three (3) for single door, two (2) at head for double door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate entire interior of exterior frame components with polyurethane foam insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide two (2) anchors for rebate opening heights up to 1520 mm / 5’-0” and one (1) additional anchor for each additional 760 mm / 2’-6” of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm / 6” from top and bottom of each jambs and intermediate at 660 mm / 26” on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: insulated hollow steel construction, size as indicated x 45 mm / 1 3/4" thick, unless otherwise indicated.

.3 Interior doors: honeycomb hollow steel construction, size as indicated x 45 mm / 1 3/4" thick, unless otherwise indicated.

.4 Fabricate doors with longitudinal edges locked seam welded. Grind welded seam joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.5 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketting and hardware in accordance with ASTM E 330.

.6 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.7 Factory prepare holes 12.7 mm / 1/2" diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.8 Reinforce doors where required, for surface mounted hardware. Provide inverted, recessed, spot welded channels to top and bottom of interior and exterior doors and finish with flush PVC top and bottom caps.

.9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.10 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104 NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.11 Manufacturer's nameplates on doors are not permitted.

2.11 HOLLOW STEEL CONSTRUCTION

.1 Form face sheets for exterior doors from 1.6mm / 16 ga. sheet steel.

.2 Form face sheets for interior doors from 1.6 / 16 ga. sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm / 6” on centre maximum.

.4 Fill voids between stiffeners of exterior doors with fiberglass insulation.

.5 Fill voids between stiffeners of interior doors with honeycomb core.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.

.4 Apply insulation to entire frame interior.

PART 3- EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including

product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1220 mm / 4’-0” wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material in accordance with Section 07900 – Joint Sealants.

.6 Maintain continuity of air / vapour barrier. Provide continuous air / vapour barrier seal between thermal break of thermally broken frame and air / vapour barrier of exterior wall system with air / vapour barrier transition membrane. Refer to Section 07270- Air / Vapour Barriers.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08710 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
- .1 Hinge side: 1.0 mm / 3/64”.
- .2 Latchside and head: 1.5 mm / 1/16”.
- .3 Finished floor, top of carpet, non-combustible sill, and thresholds: 13 mm / 1/2".

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufactures' Association except as noted.

.2 CAN/CGSB-69.17-M86/ANSI/BHMA A156.2-1983, Bored and Preassembled Locks and Latches.

.3 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.

.4 CAN/CGSB-69.19-M89/ANSI/BHMA A156.3-1984, Exit Devices.

.5 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).

1.2 REQUIREMENTS REGULATORY AGENCIES

.1 Use only ULC listed and labelled hardware for labelled doors in fire separations and exit doors.

1.3 HARDWARE LIST

.1 Submit contract hardware list in accordance with Division 01.

.2 Indicate hardware proposed, including make, model, material, function, size, finish and other pertinent information.

.3 List shall be compiled by a registered A.H.C. member and shall bear his name and certification as to the appropriateness of all items.

.4 Submit catalogue cuts of all hardware items.

1.4 MAINTENANCE DATA

.1 Provide operation and maintenance data for door closers, locksets, door holders and fire exit hardware for incorporation into manual specified in Division 01.

1.5 MAINTENANCE MATERIALS

.1 Supply two sets of wrenches or additional keys for door closers, locksets and exit devices.

1.6 KEYING

.1 Follow Owner’s keying schedule, type and system.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Store finishing hardware in locked, clean and dry area.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label

each package as to item definition and location.

1.8 INSPECTION

.1 The A.H.C. member in the employ of this trade shall be directly responsible for inspecting and directing the installation and commissioning of this work. Inform the Contractor and the Consultant in writing of such inspections, pointing out errors, omissions, etc., so that same may be corrected.

.2 At completion of the work, the A.H.C. member shall check the installation of all finish hardware, shall assist in making minor adjustments required, supervise all hardware replacements required and report to the Consultant on completeness of the installation.

.3 Use tradesmen competent in the installation of finishing hardware. Adjust clean and make good all finishing hardware to the satisfaction of the Consultant and A.H.C. member.

1.9 WARRANTY

.1 The warranty period in GC-12.3: Warranty and Relevant Supplementary Conditions, is, with respect to this section of the work, extended from one year to two years. Provide a written guarantee in the name of the Owner.

PART 2- PRODUCTS

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for all similar items. Hardware shall conform to the following minimum general requirements except as noted otherwise.

.2 Stainless steel items: AISI Type 302 or 304.

.3 Butts: To CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981.
- .1 Butts to be Hager Hinge, 4½ x 4 stainless steel, ball bearing hinges. Equivalent items by Stanley Works or MontHard are acceptable.
- .2 Use 1½ pair per door. Use 2 pair for doors over 2180 mm high. Use non-removable pins on exterior doors. Butts to be minimum BB1279.

.4 Continuous Hinges:
- .1 ANSI/BHMA A156.26-2006.
- .2 Continuous hinges for aluminum doors are to be full mortised aluminum gear type extruded from aluminum alloy.
- .3 Continuous hinges are to have pair-matched hinge leaves, lifetime lubrication and a continuous lifetime warranty.
- .4 The finish is to be anodized after matching.

.5 Latches, Locksets and Cylinders: To ANSI 156.2 Series 4000 Grade 1.
- .1 Locks will be heavy duty bored with lever handles and removable core except as noted. Strikes will be provided as required for latches and locksets specified. Non-ferrous components will be used for all doors. Finish C26D.
- .2 Acceptable Manufacturer:
  - .1 Sargent
  - .2 Schlage

.3 Stanley

.6 Exit Devices:
- .1 To CAN/CGSB-69-19-M89/ANSI/BHMA A 156.3-1984 modern (touch bar) design. Hardware supplier to coordinate exact catalogue number and trim required. Unless otherwise noted, all removable mullions to be fire rated type. All mullions to incorporate stabilizer blocks. All devices to be doggable unless fire rated; provide cylinder dogging on interior of all non-fire rated devices. Cylinders to be masterkeyed. Finish C32D bar, C32D body.
- .2 Standard of Acceptance: Sargent 80 Series with ET trim as indicated.

.7 Door Closers and Accessories:
- .1 ANSI/BHMA A156.4-2000.
- .2 Door closers are to be Grade 1 with cast iron bodies, full rectangular plastic covers, fully adjustable spring power and have separate adjusting valves for backcheck, sweep and latching.
- .3 Closers are to be capable of adjustment to require no greater than 22 Newtons of force to open interior doors and no more than 34 Newtons of force to open exterior doors.
- .4 Advanced variable backcheck (AVB) and spring stop arms are to be supplied where requested in the schedule.
- .5 Closers are to be 10,000,000 cylce tested.
- .6 Provide mounting plates where required for proper mounting of closers.
- .7 Finish as noted in the hardware schedule.

.8 Door Operators:
- .1 ANSI/BHMA A156.19-2002.
- .2 Automatic door operators shall be heavy-duty c/w 2-year warranty, built-in adjustable heavy-duty doorstop, field adjustable speed control, electronic backcheck, built-in electric strike interface, onboard 1 amp power supply and sequencing board.
- .3 Actuator buttons are to be 101 mm (4”) diameter stainless steel and are to have LOGO ONLY, no wording.
- .4 Provide weather resistant (WR) gasketing for all exterior mounted actuators.
- .5 The operators and their related components are to be supplied and installed as a package by this section.
- .6 Finish to be as noted in the hardware schedule.

.9 Door Pull:
- .1 D-pull, 4612-1, Type # 2, finish 630.

.10 Push Plate:
- .1 125 mm x 500 mm (5”x20”) stainless steel plate, finish 630 with female or male pictogram.

.11 Door Stops:
- .1 Floor stops shall be cast bronze or stainless steel. Gallery #200B, 218B, 233 or 250 as applicable, or identicals by CBH or Hager. Finish C15 or C32D.
- .2 Overhead stops and holders, concealed; Glynn Johnson, use 100LP series for aluminum and metal doors. Equivalent products by Sargent or Rixson are acceptable. Set angle to suit each door situation. Finish 26D.

.12 Kick Plates:
- .1 Stainless Steel. Provide stainless steel screws. Finish C32D.
- .2 Kickplates: 1.6 mm thick x 203 mm high x full width of door except to clear stops; Gallery #80B or Hager HA 9551. Provide on all doors with closers.

.13 Thresholds:
- .1 Standard: KNC CT32 + CT16.
- .2 Extend thresholds for full width of door frame.

.14 Weatherstripping:
- .1 Weatherstripping: KNC W20V, at jambs, head.
- .2 Sweeps: KNC W24S.
- .3 Astragal: KNC W40-40P or Hager 845W x 846S.
- .4 Identical items by the following are also acceptable: KNC, Thomas, Pemko, Unique, Hager.

.15 Flush Bolts:
- .1 Provide a pair of 305 mm flush bolts for inactive leaf. Hager #HA1250, Gallery 401, Ives 458 or Glynn-Johnson FB-6. Finish C32D.

PART 3- EXECUTION

3.1 INSTALLATION

.1 Furnish manufacturer's instructions for proper installation of each hardware component.

.2 Install hardware to standard hardware location dimensions in accordance with Canadian Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturer's Association.

.3 Set exterior thresholds in two continuous beads of butyl caulking to requirements of Section 07900 – Joint Sealants.

.4 Cope thresholds around mullions and abutting door frames.

.5 Install kickplates, push plates, and weather/sound stripping after the final coat of paint completely dried and cured.

.6 Set angle for stops, holders, and stays to best suit each situation. Mount floor stops out of line of travel. Mount wall stops to strike bottom of pulls.

.7 Set closers and exit device strikes over weatherstripping so weatherstripping is uninterrupted.

3.2 SCHEDULE

.1 Group 1 – Single Interior Door
- .1 Lever handle lockset ANSI F-82
- .2 1½ pair B.B. hinges.
- .3 S.S. kickplate.
- .4 Floor or wall stop.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Aluminum Association (AA):
- .1 AA DAF-45-03(R2009), Designation System for Aluminum Finishes.

.2 ASTM International:
- .1 ASTM C475/C475M-17, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .2 ASTM C 514-04(2020), Standard Specification for Nails for the Application of Gypsum Board.
- .3 ASTM C 645-18, Standard Specification for Nonstructural Steel Framing Members.
- .4 ASTM C 754-20, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .5 ASTM C 840-20, Standard Specification for Application and Finishing of Gypsum Board.
- .6 ASTM C 919-22, Standard Practice for Use of Sealants in Acoustical Applications.
- .7 ASTM C 954-18, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- .8 ASTM C 1002-20, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .9 ASTM C 1047-19, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .10 ASTM C 1396/C 1396M-17, Standard Specification for Gypsum Board.
- .11 ASTM C 1766-15(2019), Standard Specification for Factory-Laminated Gypsum Panel Products.
- .12 ASTM D 3273-21, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- .13 ASTM E119-20, Standard Test Methods for Fire Tests of Building Construction and Materials.

.3 Gypsum Association:
- .1 GA-214-2021 Levels of Finish for Gypsum Panel Products
- .2 GA-216-2018 Application and Finishing of Gypsum Panel Products

.4 Underwriters' Laboratories of Canada (ULC):
- .1 CAN/ULC-S101-14, Fire Endurance Tests of Building Construction and Materials.
- .2 CAN/ULC-S102-18, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

- .1 Store gypsum board assemblies materials level off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
- .3 Protect from weather, elements and damage from construction operations.
- .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
- .5 Protect prefinished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.
- .6 Replace defective or damaged materials with new.

1.4 AMBIENT CONDITIONS

.1 Maintain temperature 10°C minimum, 21°C maximum for forty-eight (48) hours prior to and during application of gypsum boards and joint treatment, and for forty-eight (48) hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Exterior Grade Gypsum Sheathing (Fiberglass Faced Gypsum Board): to ASTM C1177/C1177M regular and Type X, thickness as indicated, 1220 mm / 4’-0” wide x maximum practical length.

- .1 Acceptable products:
  - .1 ‘Securock Glass-Mat Sheathing’, by CGC.
  - .2 ‘Glasroc Sheathing by CertainTeed Gypsum, Inc.
  - .3 ‘Dens-Glass Sheathing’, by Georgia Pacific.

.2 Metal Furring Runners, Hangers, Tie Wires, Inserts, Anchors: to ASTM 1280.

.3 Drywall Furring Channels: hat shaped, zinc-coated by hot-dip process 0.5 mm / 25 ga. base thickness, 22 mm x 70 mm x 0.5 mm / 7/8” x 2 3/4" x 25 ga. core thickness galvanized steel channels for screw attachment of gypsum board.

- .1 Acceptable Product:
  - .1 ‘D-1001 Drywall Furring Channels’ by Bailey Metal Products Limited.
  - .2 Or approved alternate.

.4 Steel Drill Screws: to ASTM C 1002.

.5 Stud Adhesive: to ASTM C 557.

.6 Casing Beads, Corner Beads, J Beads, Control Joints and Edge Trim: to ASTM C 1047, fill type only (non-fill type will not be accepted), 0.5 mm / 25 ga. base thickness, perforated flanges, one piece length per location.

.7 Special Beads, Trims and Profiles: to provide reveals as indicated, fill type only (non-fill type will not be accepted), 0.5mm / 25 ga. Base thickness commercial grade sheet steel with Z275 zinc finish to ASTM A653/A653M, perforated flanges; one piece length per location.

.1 Drywall J Molding trim: ½" to 5/8" trim. Acceptable product; 'J Molding' by Fry Reglet or approved alternate.

.8 Sealants: in accordance with Section 07920 - Joint Sealants.

.9 Polyethylene Dust Barrier: Type 2, 0.10 mm thick.

.10 Insulating Strip: rubberized, moisture resistant, 3 mm / 1/8" thick closed cell neoprene strip, 12 mm / 1/2" wide, with self-sticking permanent adhesive on one face, lengths as required.

.11 Joint Reinforcement for Water Resistant Board and Tile Backer Board: glass-fibre mesh tape, alkali-resistant self-adhering glass-fibre tape, 50 mm / 2" wide, 390 by 390 or 390 by 780 threads / m / 10 by 10 or 10 by 20 threads/inch.

.12 Joint Compound: to ASTM C 475, asbestos-free. acceptable products:

.1 Interior use, all locations unless otherwise noted: 'All Purpose Joint Compound', by CGC, or 'ProRoc All Purpose Joint Compound' by CertainTeed, or 'Rapid Coat' by Continental Building Products.

.2 Interior use, all locations to receive Water / Mold Resistant Board: 'Mold Resistant Lite All-Purpose Joint Compound' by CertainTeed, or approved alternate.

.3 Exterior use: 'Durabond 90', by CGC, or 'ProRoc Moisture and Mold Resistant 90' by CertainTeed, or 'Rapid Coat 90' by Lafarge Canada Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies' installation in accordance with manufacturer's written instructions.

.1 Examine work of other trades that gypsum board assemblies will be applied, for conformity to drawings. Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C 840 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C 1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C 840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm / 6” of each corner and at maximum 610 mm / 2’-0” around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.7 Install 22 mm x 64 mm / 7/8" x 2 1/2" drywall furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work has been approved.

.2 At metal deck locations where gypsum board assemblies are identified to be installed to underside of structure, scribe top of gypsum board to fit tightly into metal deck profile.

.3 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, and screw fasteners for second layer. Maximum spacing of screws as per GA-216.

- .1 Single-layer application:
  - .1 Apply gypsum board on ceilings prior to application of walls to ASTM C 840.
  - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- .2 Double-layer application:
  - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
  - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm / 10”.
  - .3 Apply base layers at right angles to supports unless otherwise indicated.
  - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm / 10” with base layer joints.

.4 Apply single layer gypsum board to concrete or concrete block surfaces, where indicated, using laminating adhesive.

- .1 Comply with gypsum board manufacturer's recommendations.
- .2 Brace or fasten gypsum board until fastening adhesive has set.
- .3 Mechanically fasten gypsum board at top and bottom of each sheet.

.5 Exterior Soffits and Ceilings: install Exterior Grade Gypsum Sheathing perpendicular to supports; stagger end joints over supports. Install with 6 mm / 1/4” gap where boards abut other work.

.6 Standard Board: to all locations unless otherwise noted.

.7 Apply water/mold resistant gypsum board in washrooms, kitchens, janitors closets, where adjacent to slop sinks, at all window head and jamb returns and where indicated. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads.

.8 Construct fire rated assemblies to ULC design numbers where indicated. In case of conflict between the provisions of the tested assembly and the assembly noted in the contract documents, the more stringent provisions shall apply.

.9 Apply 12 mm / 1/2" diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.

.10 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm / 10”.

.11 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.12 Install gypsum board with face side out.

.13 Do not install damaged or damp boards.

.14 Locate edge or end joints over continuous supports. Stagger vertical joints over different studs on opposite sides of wall.

.15 Install Gypsum Sheathing to receive air/vapour sound and free of sharp protrusions, gaps, and voids exceeding 19 mm / 3/4" in width. Use repair materials and methods acceptable to air/vapour barrier membrane manufacturer. For voids that exceed 13 mm / 1/2" in width refer also Section 07260 Vapour Retarders for air/vapour barrier void coverings.

.1 Provide metal framing backing as required to accept air/vapour barrier void coverings.

3.4 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm / 6” on centre using contact adhesive for full length.

.2 Install fill type casing beads around perimeter of suspended ceilings.

.3 Install fill type casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Install shadow mold at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces

and splicers.

.6 Construct control joints of preformed units two back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.7 Provide continuous polyethylene dust barrier behind and across control joints.

.8 Locate control joints where indicated, at changes in substrate construction, at approximate 10 m / 32’-9” spacing on long corridor runs and at approximate 15 m / 50’ spacing on ceilings to Consultant approval.

.9 Install control joints straight and true.

.10 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.11 Install expansion joint straight and true.

.12 Splice corners and intersections together and secure to each member with 3 screws.

.13 Install access doors to electrical and mechanical fixtures specified in respective sections.
- .1 Rigidly secure frames to furring or framing systems.

.14 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.15 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with GA-214 Recommended Levels of Gypsum Board Finish:
- .1 Levels of finish:
  - .1 Level 0: no tapping, finishing or accessories required.
    - .1 Provide Level 0 finish for temporary construction locations.
  - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
    - .1 Provide Level 1 finish for plenum areas above ceilings, in attics or in areas where the assembly will be concealed.
  - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
    - .1 Provide Level 2 finish for water resistant gypsum backing board is used as a substrate for tile, and at fire separations in concealed spaces such as above finished ceilings.
  - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
    - .1 Provide Level 3 finish for garages, warehouse storage or other similar areas.
    - .2 Provide Level 3 finish where areas are to receive a heavy to medium coat of textured material, or where heavy grade wall coverings are to be applied. This level of finish is not recommended where smooth painted surfaces, or light to medium weight wall coverings are specified.
  - .5 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
    - .1 Provide Level 4 finish for light textures or wall coverings are to be applied.

.6 Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
  .1 Provide Level 5 finish where gloss, semi-gloss, enamel or non-textural flat paints are specified or where severe lighting conditions occur.
  .2 Provide Level 5 finish for all locations unless otherwise indicated.

.16 Apply skim coat of joint compound as follows:
  .1 Mix joint compound for skim coating slightly thinner than for joint taping.
  .2 Apply thin skim coat to provide a light, thin coating of joint compound to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks to following locations:
    .1 Walls scheduled to receive gloss, semi-gloss or eggshell paints.
    .2 On long walls with side lighting where differences in texture between finished sanded compound and gypsum board surface would be noticeable.
  .3 Allow skim coat to dry completely.
  .4 Remove ridges by light sanding or wiping with damp cloth.

.17 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.18 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies' installation.

3.6 CLEANING

.1 Progress Cleaning:
  .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with waste management plan.
  .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM):
- .1 ASTM C645, Specification for Nonstructural Steel Framing Members.
- .2 ASTM C754, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
- .1 Safety Data Sheets (SDS).

.3 The Master Painters Institute (MPI):
- .1 Architectural Painting Specification Manual - current edition.
  - .1 MPI #26, Primer, Galvanized Metal, Cementitious.

1.2 REGULATORY REQUIREMENTS

.1 Where fire resistant ratings are specified for work of this Section, carry out work in strict accordance with fire test report data as per manufacturers written recommendations for ULC tested procedures. Work shall include, but is not limited to, fire separations, infill panels for work of other sections with a fire resistance rating, backing for equipment located in a fire separation, shaft walls and shaft wall construction where indicated.

.2 Prior to proceeding with work, submit to the Consultant, Product data and application requirements for ULC tested systems for all shaft wall construction for vertical and horizontal applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's instructions, printed Product literature and data sheets for metal framing and include Product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:
- .1 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .1 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details.
  - .2 Indicate locations, dimensions, openings and requirements of related work.
- .2 Design suspension system to accommodate seismic restraint in accordance with Section 01331 - Seismic Design of Operational Functional Components.
- .3 Submit reflected ceiling plans for suspended framing as indicated.
- .4 Submit reflected ceiling plans for special grid patterns as indicated.
  - .1 Indicate lay out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, change in level details, access door dimensions, and locations and acoustical unit support at ceiling fixture, lateral bracing and accessories.

.3 Test Reports: Certified test reports showing compliance with specified performance characteristics

and physical properties.

.4 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect metal framing from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Non-Load Bearing Channel Stud Framing: to ASTM C645, stud size as indicated, roll formed, hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm / 18” centres. Provide roll formed minimum gauge thickness for wall types as follows:
- .1 1 mm / 20 gauge for all board types in non-loadbearing walls unless otherwise indicated.
- .2 1 mm / 20 gauge for all non-loadbearing walls identified with a fire resistance rating.
- .3 1 mm / 20 gauge for all non-loadbearing walls identified to receive Abuse Board or Cement Board.

.2 Floor and Ceiling Tracks: To ASTM C645, in widths to suit stud sizes, 32 mm / 1-1/4" flange height.

.3 Non-load Bearing Truss Stud Framing System to consist of:
- .1 Studs: 92 mm size; truss-type bent rod web with double rod chords; welded together at contact points. Make rod of minimum 4.5 mm diameter cold drawn steel wire having tensile strength of 620 MPa. Design studs for clip attachment of gypsum lath or wire tying of metal lath.
- .2 Floor track: Snap-in type formed to hold studs securely in place at 50 mm / 2” intervals; fabricated from 0.5 mm / 27 ga. thick steel sheet; size to suit studs.
- .3 Ceiling track: Channel shaped track for use with stud shoes and 1.2 mm / 18 ga. diameter double wire ties; size to suit studs.

.4 Deflection Ceiling Track: Purpose made with 64 mm / 2-1/2” leg x width to suit stud depth, pre-punched 38 mm / 1-1/2" long slots spaced at 25 mm / 1” o/c.
- .1 Acceptable Product: ‘Multi-slot MST 250’ by Bailey Metal Products Limited, or approved alternate.

.5 Metal Channel Stiffener: Size to suit, 1.4 mm / 1/16” thick cold rolled steel, coated with rust inhibitive coating.

.6 Acoustical Sealant: In accordance with Section 07 92 00 – Joint Sealants.

.7 Insulating Strip: Rubberized, moisture resistant 3 mm / 16 ga. thick closed cell neoprene strip, 12 mm / 1/2" wide, with self-sticking adhesive on one face, lengths as required.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 ERECTION

.1 Refer to Section 05 41 00 – Structural Metal Stud Framing, for all exterior wall framing.

.2 Align partition tracks at floor and ceiling and secure at 610 mm / 24” on centre maximum.

.3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.4 Place studs vertically at 400 mm / 16” on centre and not more than 50 mm / 2” from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.5 Erect metal studding to tolerance of 1:1000.

.6 Attach studs to bottom and ceiling track using screws.

.1 Where walls are to accommodate deflection, erect studs using purpose made deflection ceiling tracks.

.7 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.8 Coordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.9 Provide two (2) studs extending from floor to ceiling at each side of openings wider than stud centres specified.

.1 Secure studs together, 50 mm / 2” apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.10 Install heavy gauge single jamb studs at openings.

.11 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.12 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.13 Provide 40 mm / 1-5/8” stud or furring channel secured between studs as required to accommodate wood blocking for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions. Coordinate with Section 06100 - Rough Carpentry.

.14 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.15 Extend partitions to ceiling height except where noted otherwise on Drawings.

.16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

.1 Use 64 mm / 2-1/2" leg purpose made deflection ceiling tracks as specified.

.17 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.18 Install two continuous beads of acoustical sealant and continuous insulating strip under studs and tracks around perimeter of sound control partitions.

3.3 PROTECTION

.1 Protect installed Products and components from damage during construction.

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.2 The Master Painters Institute (MPI)
  .1 Architectural Painting Specification Manual - current edition.
  .2 Maintenance Repainting Manual - current edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01330 - Submittal Procedures.

.2 Product Data:
  .1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.
  .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01561 - Environmental Protection.

.3 Samples:
  .1 Submit for review and acceptance of each unit.
  .2 Samples will be returned for inclusion into work.
  .3 Submit duplicate 203 x 305 mm / 8” x 12” sample panels of each paint stain clear coating special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
  .1 Provide and maintain dry, temperature controlled, secure storage.
  .2 Store painting materials and supplies away from heat generating devices.
  .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.

.4 Fire Safety Requirements:
  .1 Supply 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
  .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.5 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.

1.4 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:
- .1 Ventilate enclosed spaces in accordance with Section 01510 - Temporary Utilities.
- .2 Co-ordinate use of ventilation system with Consultant and ensure its operation during and after application of paint as required.
- .3 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:
- .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
- .2 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.

.3 Additional application requirements:
- .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
- .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2- PRODUCTS

2.1 MATERIALS

.1 Supply paint materials for paint systems from single manufacturer.

.2 Conform to latest MPI requirements for painting work including preparation and priming.

.3 Materials in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual "Approved Product" listing.

.4 Colours:
- .1 Consultant will provide Colour Schedule after Contract award.
- .2 Base colour schedule on selection as follows: one (1) base colour, two (2) accent colours, one (1) colour for doors, and one (1) colour for frames.

.5 Mixing and tinting:
- .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Consultant for tinting of painting materials.
- .2 Use and add thinner in accordance with paint manufacturer's recommendations.
  - .1 Do not use kerosene or similar organic solvents to thin water-based paints.
- .3 Thin paint for spraying in accordance with paint manufacturer's written recommendations. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.
- .4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

.6 Gloss/sheen ratings:
- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level - Category	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - (Matte Finish)	Max. 5	Max. 10
Gloss Level 2 - (Velvet)	Max. 10	10 to 35
Gloss Level 3 - (Eggshell)	10 to 25	10 to 35
Gloss Level 4 - (Satin)	20 to 35	min. 35
Gloss Level 5 (Semi-Gloss)	35 to 70	
Gloss Level 6 - (Traditional Gloss)	70 to 85	
Gloss Level 7 - (High Gloss)	More than 85	

.2 Gloss level ratings of painted surfaces as indicated and as noted on Finish Schedule.

.7 Exterior painting:
- .1 Galvanized Metal: not chromate passivated (doors, and frames)
  - .1 EXT 5.3B - Alkyd semi-gloss finish.

.8 Interior painting:
- .1 Concrete masonry units: smooth block:
  - .1 INT 4.2A - Latex semi-gloss finish.
- .2 Metal Fabrications: miscellaneous metal, stairs and railings.
  - .1 INT 5.1A - Quick dry enamel semi-gloss semi-gloss finish.
- .3 Galvanized Metal: doors, and frames.
  - .1 INT 5.3L - Alkyd semi-gloss finish (over non-cementitious primer).
- .4 Plaster and gypsum board: gypsum board ceiling finishes:
  - .1 INT 9.2B - High performance architectural latex matt gloss level finish.

PART 3- EXECUTION

3.1 GENERAL

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

.3 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual and MPI - Maintenance Repainting Manual except where specified otherwise.

3.2 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PREPARATION

.1 Protection of in-place conditions:
- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other

damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Consultant.
.2 Protect items that are permanently attached such as Fire Labels on doors and frames.
.3 Protect factory finished products and equipment.

.2 Surface Preparation:
.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Consultant.
.4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual and MPI - Maintenance Repainting Manual specific requirements and coating manufacturer's recommendations.
.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
.6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
.7 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
.1 Apply wood filler to nail holes and cracks.
.2 Tint filler to match stains for stained woodwork.
.8 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
.9 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
.10 Touch up of shop primers with primer as specified.

3.4 APPLICATION

.1 General:
.1 Finish all exposed to view unfinished materials and all previously painted surfaces in area of new Work and as scheduled.
.2 Finish paint all primed surfaces.
.3 Do not paint baked enamel, chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory.
.4 Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.
.5 Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas, which have been cut and patched. Patch paint will not be accepted.
.6 Sand smooth enamel and varnish undercoats prior to recoating.
.7 Apply primer coat soon after surface preparation is completed to prevent contamination of substrate.
.8 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
.9 Apply coats of paint continuous film of uniform thickness.
.1 Repaint thin spots or bare areas before next coat of paint is applied.
.10 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
.11 Sand and dust between coats to remove visible defects.
.12 Finish surfaces both above and below sight lines as specified for surrounding surfaces.
.13 Finish closets and alcoves as specified for adjoining rooms.

.14 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

.2 Apply paint by brush roller air sprayer airless sprayer. Method of application to be as approved by Consultant.
  .1 Brush and Roller Application:
    .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
    .2 Work paint into cracks, crevices and corners.
    .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
    .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
    .5 Remove runs, sags and brush marks from finished work and repaint.
  .2 Spray application:
    .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
    .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
    .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
    .4 Brush out immediately all runs and sags.
    .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
    .6 Spray paint all doors and frames scheduled to be painted. Final coat may be brushed or rolled to accommodate finished adjacent surfaces.
    .7 Spray paint overhead doors.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01741 - Cleaning.
  .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01741 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 01.
  .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.4 Place paint stains primer defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 Includes the supply, installation, commissioning and testing of positive displacement metering pumps, required controls for feeding chemicals to the process.

.2 Includes the supply and commissioning of chemical feed system appurtenances.

.3 Pump performance and quantities scheduled.

1.2 REFERENCES

.1 The following is a list of standards in this section. Unless otherwise noted and where applicable, the references indicated shall be the latest standard adopted by the regulatory agency as of the project tender date.

- .1 Hydraulic Institute Standards (HI).
- .2 National Electrical Manufacturers Association (NEMA).
- .3 Ontario Electrical Safety Code (OESC).
- .4 Canadian Standards Association (CSA):
  - .1 CSA Z432 – Safeguarding of Machinery.

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15 requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 Provide spare parts in accordance with procedures Division 1.

.2 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed equipment.

1.6 QUALITY ASSURANCE

.1 Chemical metering pump manufacturer’s factory trained representative to provide a written certification on OEM letterhead stating that the pump(s) is installed to their standards.

.2 Pump manufacturer’s plant to be ISO 9001 certified.

.3 Pumps to be approved to Canadian standards and must bear markings or labels by the Electrical Safety Authority. Refer to the Ontario Electrical Safety Code.

.4 All guarding to be to CSA 7432 and to OSHA standards.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Chemicals to be handled by specified pumps are as follows:

.1 Alum Solution:

DESCRIPTION	ALUM
Chemical Formula	$AL_2(S0_4)_3$
Concentration	48.5%
Density @ 20°C	1.34 kg/L
Temperature	18-25°C
pH	2 – 2.4

.2 The chemical feed system is to come as a pre-mounted, pre-piped, pre-wired, and pressure tested system. The components on the board are as outlined on the drawings and detailed herein. Pumps are to be supplied with a separate mounting platform to be attached to the wall below the chemical feed system board.

2.2 DIAPHRAGM PUMPS

.1 General Description: Provide one (1) positive displacement, mechanically actuated type, driven by gear assembly to the electric motor. Motor to be driven by stepper motor and be in accordance with Section 15053. Liquid ends shall provide for easy maintenance, integral sight flow indication via cartridge-type TFE check valves. Pump to operate at 100% stroke length throughout the entire pump capacity.

.2 Enclosure: Pump enclosure rating to be to IP65 and NEMA 4X standards.

.3 Drive: Pump stroke length to be 100%. Motor to be stepper type providing minimum of 1000:1 turndown. Motor to be coupled to a flat PDFE diaphragm via a gear assembly. Drive mechanism

shall not require external lubrication.

.4 Liquid End: diaphragm shall be PTFE; head and valves body material shall be PVC with ceramic ball material. Wetted gasket material shall be PTFE. Suction and discharge valve shall incorporate double ball arrangement. Direction of flow shall be clearly marked on each check valve. Head design shall incorporate integral priming valve. A back-plate with separation chamber shall have a safety lip seal and drain hole.

.5 Control:
- .1 Pumps to be controlled by flow proportional signal and variable frequency drive supplied by the preselected MCC supplier.
- .2 Provide diaphragm leak detection contacts to be monitored by plant PLC.
- .3 Pump Capacity.
  - .1 Each pump required to automatically pump in a range as follows.

Flow	TDH
290 l/hr	900 kPa

.6 Provide a Form C contact to indicate pump running.

.7 Controls:
- .1 Supply auto control features to meet the following minimum functionality requirements for use with the SCADA system.
- .2 Remote Control Inputs:
  - .1 Speed Control:
    - .1 Analog 4-20 mA with input signal trimmable and speed scaleable over any part of the drive speed range.
    - .2 Provisions for alternative remote accessory potentiometer (if supplied by others).
  - .2 Stop/Start Control: Via dry contact – configurable command sense allowing open to equal run or open to equal stopped.
  - .3 Forward/Reverse Control: via dry contact.
  - .4 Auto/Man Mode Control: via dry contact.
  - .5 Leak Detector Run/Stop Control: via dry contact.
- .3 Status Outputs:
  - .1 Form C dry contact relays each rated for 120 VAC with a minimum load of 120 VA to indicate the following:
    - .1 Running/Stopped status.
    - .2 Auto/Manual status.
    - .3 General Alarm status.
    - .4 Leak Detected status.
  - .2 Speed Output: Analogue 4-20 mA.
- .4 Termination: supply screw down terminals suitable for a range of 18 AWG to 12 AWG, field wired and accessible through glanded cable entry points on the pump.

.8 Specified Product: Seimens Encore 700 series.

2.3 APPURTENANCES

.1 Calibration Columns:
- .1 Provide where indicated on drawings.

.2 Rugged, transparent, Schedule 40 PVC construction.
.3 Column to be in mL and standard 10 mL divisions.
.4 Column to be sealed and vented.
.5 Shop fabricated products are not acceptable.
.6 Size according to the following:

CALIBRATION COLUMN SIZE	PUMP SIZE
(mL)	(4hr.)
500	60
1000	125
2000	250
4000	450

.7 Specified Product: Primary Fluid Systems Accudraw.
.8 Alternate Product:
  .1 Griffco Valve.
  .2 Milton Roy.

.2 Pulsation Dampers:
  .1 Provide where indicated on drawings.
  .2 Hydro pneumatic bladder type, oriented in vertical position.
  .3 Pulsation dampener to be constructed with two chambers, a fluid chamber and pressure chamber separated by an elastomeric bladder.
  .4 Design the damper for a minimum 4:1 burst pressure to maximize pressure ratio.
  .5 Design the damper to handle the pump's maximum stroke or revolution volume.
  .6 Pulsation damper to be equipped with a gas fill valve and pressure gauge.
  .7 Specified Product: Primary Fluid Systems Accupulse.
  .8 Alternate Manufacturers:
    .1 Griffco Valve.
    .2 Milton Roy.

2.4 PIPING/TUBING

.1 Refer to Section 15349 – Process Piping.

2.5 VALVES

.1 Refer to Section 15100 – Process Valves and Actuators.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install chemical feed pump and appurtenances in accordance with manufacturer's written instructions.

.2 Provide equipment identification tags consistent with P&ID drawings and Section 15020.

.3 Provide minimum 300 mm length of flexible tubing complete with camlock couplings at the inlet and outlet of each chemical feed pump.

3.2 PIPING

.1 All tubing to be routed in secondary containment piping unless indicated otherwise.

.2 Piping to all tanks to be arranged for convenient dismantling.

.3 Arrange piping to feed pumps so that pumps can be conveniently dismantled.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This section covers the supply, installation, testing and commissioning of the self priming centrifugal type pumps c/w appurtenances as specified herein.

.2 Refer to the Pump Schedule for pump quantities and design operating parameters.

.3 Refer also to the drawings for additional installation requirements.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.

- .1 American Society of Mechanical Engineers (ASME):
  - .1 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- .2 American Society for Testing and Materials (ASTM):
  - .1 ASTM A48: Standard Specification for Gray Iron Castings.
  - .2 ASTM E165: Standard Practice for Liquid Penetrant Examination for General Industry.
- .3 American Iron and Steel Institute (AISI).
- .4 Hydraulic Institute Standards:
  - .1 HI 14.6: Standard for Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
- .5 International Organization for Standardization (ISO):
- .6 ISO 9906: Rotodynamic Pumps – Hydraulic Performance Acceptance Test.
- .7 National Electrical Manufacturer’s Association (NEMA).
- .8 American Bearing Manufacturers Association (ABMA).
- .9 Ontario Electrical Safety Code (OESC).
- .10 Canadian Standards Association (CSA).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted section, submit the following for all PART 2 – PRODUCTS.

- .1 Product Data:
  - .1 Relevant information to confirm that the specifications have been met.
  - .2 Identify construction materials for all pump components.
  - .3 Relevant data illustrating full range of operation (on pump curves) including speed curves, if applicable.
  - .4 Electrical motor information and specification.
  - .5 Loading imparted to the pump base.
  - .6 Permissible range of vibration.
  - .7 Factory finishing details.
  - .8 Noise characteristics of equipment.
  - .9 Anchoring requirements.
  - .10 The pump manufacturer shall submit power transmission calculations which document the

following:
- .1 Ratio of pump/motor speed.
- .2 Pitch diameter of driver and driven sheaves.
- .3 Number of belts required per drive.
- .4 Theoretical horsepower transmitted per belt, based on vendor's data.
- .5 Center distance between pump and motor shafts.
- .6 Arc-length correction factor applied to theoretical horsepower transmitted.
- .7 Service factor applied to established design horsepower.
- .8 .8 Safety factor ratio of power transmitted/brake horsepower.

.2 Operation and Maintenance Data:
- .1 Operation and Maintenance Manuals. Refer to Division 1 for requirements.
- .2 Manufacturer's installation requirements.

.3 Quality Control Data:
- .1 Manufacturer's certified testing results.
- .2 Manufacturer's certificate confirming proper installation.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed pumps.

.2 For each pump model and size, provide the following spare parts:
- .1 One set of spare belts per pump provided.
- .2 One set of mechanical seals.
- .3 One set of gaskets.

.3 Provide any specialty tools required to maintain the pump.

1.6 QUALITY ASSURANCE

.1 Pump manufacturer to provide a written certification stating that the pump(s) has(have) been installed to their standards.

.2 Pumps and associated equipment to be approved to Canadian standards and must bear markings or labels by the Electrical Safety Authority. Refer to the Electrical Safety Code.

.3 Pump manufacturer to have proven established network of service centres in Eastern Ontario. Service centres to be specialized in manufacturer's line of pumps and stock spare parts. Each service centre to be capable of removing, transporting and repairing the pump in addition to supplying a rental or temporary unit.

.4 Pumps to be factory tested to HI 14.6 Standard Grade 3B.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

.2 All components including the pumps, motors, and controls will be tested at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual anticipated performance.

.3 Certified reprime performance test results, prepared by the manufacturer, and certified by a Registered Professional Engineer, shall be submitted for approval prior to shipment.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 All part 2 equipment will require training

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

.2 Pumps to be provided with a five (5) years warranty.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Self priming pump to be capable of pumping grit and various sludges typical to municipal wastewater. Pump performance as indicated herein or as scheduled.

.2 Each pump shall be designed as to retain adequate liquid in the pump casing to ensure unattended repriming while operating at its rated speed in a completely open system without check valves and with a dry suction leg.

.3 Pump must reprime 3.25 m vertical metres at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition

.4 Openings and passages of pump shall be large enough to permit the passage of a sphere 60 mm in diameter. Pump volute or casing shall contain no openings, such as recirculation ports, of a lesser diameter than spheres sizes specified

.5 All guarding to be to CSA Z432 and to OSHA standards.

.6 Coordinate with Contractor's designer for seismic support systems and provide all necessary attachments and reinforcing of equipment.

2.2 PUMP FABRICATION

.1 Pump Casing:

.1 Casing shall be made of ASTM A40 Class 30 grey iron with internal volute scroll. Integral cast mounting feet ANSI suction and discharge flanges, 90 mm fill port, 32 mm drain. Fabricate of ductile cast iron.

.2 Impeller:

.1 Multi-vane, semi-open, hardened ductile iron impeller for abrasive service, with integral pump-out vanes on the back shroud. The impeller shall thread onto a pump shaft of AISI 17-4 Ph stainless steel, and be secured with an impeller locking screw.

.3 Cover Plate

.1 Pump must be equipped with a lightweight removable inspection cover plate, allowing complete access to the pump interior to permit the clearance of stoppages and to provide simple access for services and repair without disturbing suction or discharge piping.

.2 Pump to be equipped with a removable adjustment cover plate

.3 Both cover plates to be constructed of ASTM A40 Class 30 grey iron.

.4 Wear Plate:

.1 Pumps shall be fitted with a replaceable hardened steel wear plate.

.2 Wear plate to be constructed of AISI 1015 Carbon Steel.

.5 Pump Shaft:

.1 Fabricated to be constructed of AISI 1015 Carbon Steel.

.6 Bearings:

.1 Shaft shall be contained within bearing pedestal of ample size to contain heavy ball bearing thrust loads and radial bearings of adequate size to withstand all imposed loads.

.2 Bearings shall be oil lubricated from a dedicated reservoir, with the bearing pedestal cooled by pumped liquid.

.3 Bearings to carry radial and axial loads for a minimum bearing life of ABMA L10 100,000 hours under maximum load conditions.

.7 Seals:

.1 A mechanical seal shall seal pump shaft against leakage. Cartridge floating type mechanical oil lubricated seal with Viton O-rings.

.2 Rotating and stationary seal faces shall be tungsten titanium carbide, cage and spring shall be stainless steel, and elastomers shall be Viton.

.3 Mechanical seal shall be installed within a seal housing adjacent to an oil filled reservoir in the pump pedestal, the oil serving as both lubricating and cooling media

.4 Maximum Temperature of pumped liquid: 71C (160F)

.8 Rotating Assembly

.1 Entire rotating assembly, which includes bearings, shaft, seal and impeller, shall be removed as a unit without disturbing pump casing or piping. Means shall be provided for external adjustment of the impeller to the wear well.

.9 Unit Base:

.1 One-piece base plate shall be fabricated of steel not less than 6.00mm thick, and shall

incorporate openings for access to all internal cavities to permit complete grouting of unit base after installation.

.10 Suction Valve:

.1 Pump shall incorporate suction check valve that can be removed or installed through removable cover plate opening without disturbing the suction piping.

.2 Sole function of the check valve shall be to eliminate re-priming with each cycle. Pumps requiring non integral suction check valves to perform will not be acceptable.

2.3 COATINGS

.1 Exposed surfaces to be coated with one coat grey wear resistant non-lift primer and one coat white acrylic alkyd wear resistant enamel, incorporating rust inhibitive additives. The finish coat shall be 1.0 to 1.2 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray.

.2 Any surface preparation and field painting to be done in accordance with Section 15020 and Division 9.

2.4 DRIVE UNIT AND TRANSMISSION

.1 TEFC motor suitable to be electrically rated to suit classifications shown on drawings.

.2 Motor to meet the requirements of Section 15053.

.3 V-belt drive. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

.4 Utilize at least two V-belts providing a minimum combined safety factor of 1.5 at the maximum pump speed and impeller size.

.5 Belt guarding to be to OSHA and/or CSA Standards.

2.5 CONTROLS

.1 Refer to the Contract Drawings and Process Control Narrative for the proposed control methodology.

.2 The pumps will be controlled through a Programmable Logic Controller (PLC). The PLC will be provided as part of Division 16.

.3 Pump starters will be provided as part of Division 16.

2.6 SPECIFIED PRODUCT

.1 Gorman Rupp T3A or T4A Series as required.

2.7 ALTERNATE MANUFACTURERS

.1 Goulds.

.2 Weir.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Self priming pumps complete with all accessories are to be installed in accordance with manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

.1 General:
- .1 Pump supplier shall complete Manufacturer's Certificate of Proper Installation upon satisfactory installation of the equipment.
- .2 Refer to Division 1 for additional testing requirements.
- .3 Pump supplier shall calibrate instruments, sensors, and meters supplied for testing.

.2 Functional Testing:
- .1 Functional testing shall be conducted after the installation of the pump(s) and all related appurtenances are complete, to verify proper operation of all the equipment and controls under wet-run conditions.
- .2 The Equipment Supplier, in coordination with the Contractor, will provide all temporary measures required for the functional tests. Written test procedures shall be submitted to the Consultant for approval a minimum of 60 days prior to testing.
- .3 The functional tests shall determine the characteristics of each unit and demonstrate the units:
  - .1 Have not been damaged by transportation or installation.
  - .2 Have been properly installed.
  - .3 Have no mechanical defects.
  - .4 Are in proper alignment.
  - .5 Have been properly connected.
  - .6 Are free of overheating of any parts.
  - .7 Are free of objectionable vibration and noise as specified.
  - .8 Are free of overloading of any parts.
  - .9 Are properly lubricated.
  - .10 Respond properly to all start-up and shutdown sequences.

.3 Vibration Test: Vibration testing shall be conducted during field functional testing. The Equipment Supplier shall verify operations are within tolerances and the vibration signature recorded over the frequency domain.
- .1 Provide vibration signature test data for each pump and drive assembly for comparison to factory testing data.

.4 Test each unit to ensure pump delivers rated capacity in Consultant's presence.

.5 Test electrical loading to ensure pump operates efficiently without electrical overload.

.6 Noise Test: Perform noise testing in the field with equipment installed and operating at peak capacity to verify noise produced by the equipment. Noise from equipment to be less than or equal to those listed by the manufacturer.

3.3 IDENTIFICATION

.1 Pumps are to be tagged consistent with the Contract Drawings and the requirements of Section 15020.

3.4 SUPPLEMENTS

.1 Pump Schedule included at the end of this section.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 The screening system has been reviewed and it has been identified that repairs are required for continued operation.

.2 Contactor to coordinate screening schedule with municipality and OEM to ensure that the screen is offline during an optimal time for the Municipality, and minimizing downtime for the screen.

.3 Clearly identify materials and equipment to be removed, retained or to remain in place prior to commencement of work. Complete walkthrough with Consultant and Owner. Physically mark items for, and extent of repairs, demolition and document scheduling and constraints.

.4 Any removals to be conducted in accordance with 15012.

.5 A review of the screen has been conducted by the OEM and a report has been provided in Appendix 7.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3- EXECUTION

3.1 REPAIRS

.1 Prior to undertaking any repairs, removals, or other work, Contractor to review the Designated Substances Survey and complete any required abatement.

.2 Contractor to obtain all operation and controls information for the screen from the Client and associated control systems prior to completing any repairs such that the screen can be recommissioned to the same control requirements after repairs are completed.

.3 The contractor is to have the screen OEM (Veolia Water Technologies Inc) complete all repairs associated with the screen. The Contractor is to provide assistance to the OEM as required for them to complete their repairs. OEM to provide all components, materials, hardware, etc. required for the repairs. Any other system serving the screen which was disconnected during the repair is to be reinstated to like-new condition.

.4 All required repairs are noted in the report provided by the OEM in Appendix 7 are to be provided by the OEM. If, during the course of the repairs, any additional work outside of what is noted in Appendix 7 is discovered, Contractor to notify Engineer, indicating the extents of what is required, and wait for further instruction.

.5 Upon completion of the repairs, the screen is to be put back into working order. Screen OEM to provide a letter indicating that all repairs have been completed and that the screen is fully operational. Report to comment on each individual item repaired as noted in the OEM initial

investigation report in Appendix 7.

.6 Contractor to recommission repaired screen, demonstrating all automatic and manual functions for a fully operational system. This includes, but is not limited to the screen automatically energizing/denergizing, automatic washwater being provided as required, compactor operating in conjunction with the screen as required. All screen operations to match the original operation of the screen prior to repairs being started. Provide all testing and commissioning for the reinstated components and associated support systems in accordance with the associated relevant specification sections.

.7 Temporarily remove existing equipment, services, and obstacles where required to complete the new work and replace same as work progresses.

.8 Maintain adequate structural support during removal of equipment and material.

3.2 PREPARATION

.1 Disconnect and cap mechanical services to be reconnected after repairs are complete. Identify all services prior to taking them offline. Services to be capped to standards of new piping and/or ductwork specifications in this Division.

.2 Do not disrupt active services for other facilities.

.3 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interior of parts not associated with the repairs at all times.

3.3 RESTORATION

.1 Restore existing work damaged due to this work to a condition equal to that before work began and to satisfaction of Consultant.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 The General Contractor is to provide a screening compactor system within the Screening Room in compliance with these specifications and as shown on the Drawings.

.2 Screening system provisions include a screenings washer/compactor, a screenings bagger, and a controller panel. To harmonize the control of all the above equipment the Manufacturer is required to provide a local control panel, a single Motor Starter Control Panel serving the equipment, and connect the new compactor back into the existing screening control panel for harmonized operation with the existing screen. Coordinate equipment supply with this specification and the drawings.

.3 The System Supplier is to provide a complete package to include all necessary components, including mounting brackets, removal davits, supports, drives, guards, controls and electrical to limits indicated herein. Generally, unless indicated otherwise, the supplier is to provide a complete and working system to satisfy performance requirements and general intent specified in the documents.

.4 Unless noted otherwise all electrical components installed in the Screening Room shall be suitable rated for a Zone 1 electrical classification minimum to ensure continued screen operation if ventilation system is offline.

1.2 REFERENCES

.1 The following is a list of standards that may be utilized in this section. Unless specifically noted otherwise, the reference indicated shall be the latest standard adopted by the regulatory agency as of the tender date.
- .1 American Iron and Steel Institute (AISI)
- .2 American Gear Manufacturers Association: (AGMA).
- .3 American Society of Mechanical Engineers (ASME):
  - .1 ASME B30.16 – Overhead Underhung and Stationary Hoists.
- .4 American Society of Testing and Materials (ASTM).
- .5 Canadian Electrical Manufacturers Association CEMA).
- .6 Canadian Standards Association: (CSA).
  - .1 CSA Z432 – Safeguarding of Machinery.
- .7 National Electrical Manufacturers Association: (NEMA).
- .8 Underwriters Laboratories (UL).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15.

.2 Informational submittal required for all Part 2 – Products specified herein.

.3 In addition to the submittal requirements of Division 1 and Division 15 submit the following:
- .1 Product Data
  - .1 Identify construction materials for all screenings compactor components.
  - .2 Relevant data illustrating full range of operation including speed curves, if applicable.
  - .3 Electrical motor information and specification.
  - .4 Loadings imparted to each piece of equipment.
  - .5 Permissible range of vibration.

.6 Factory finishing details.
.7 Anchoring requirements.
.8 A motor performance chart exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. Chart to also include date on motor starter and no-load characteristics.
.9 Noise characteristics of equipment.
.10 Provide Instrumentation and Control Systems submittals including, but not limited to the following:
  .1 Piping and Instrumentation Diagrams (P&IDs).
  .2 Process Control Narrative.
  .3 Centralized Control Panel and Local control Panel layouts complete with component bill of materials.
  .4 Panel product shop drawings for utilized PLC controllers, power supplies, controller cards, touch screen interface, intrinsically safe relays, terminal block, surge protective devices, starters and drives.
  .5 Field instrumentation product shop drawings and data sheets.
  .6 Control Panel schematics and wiring diagrams, including field loop diagrams and network schematics.
  .7 All HMI screens.
  .8 PLC program.
  .9 Field instrument classification ratings as well as specific installation details.
  .10 Submit lifting davit shop drawings stamped by a professional engineer registered in the province of Ontario.

.2 Maintenance Data:
  .1 Operation and Maintenance Manuals in accordance with Division 1.
  .2 Installation requirements.
  .3 The Supplier is to submit all operating constraints and design requirements related to the successful commissioning of the screens, washing, and compacting equipment.

.3 Quality Control Data:
  .1 A certificate of proper installation submitted on OEM letterhead, signed by the Manufacturer or their representative and certifying that the equipment has been installed in accordance with their installation instructions
  .2 Factor testing reports

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 Maintenance and Spare parts to be in accordance with Division 1 requirements

.2 Contractor shall verify and demonstrate that proper maintenance can be performed on equipment and material installed.

.3 Provide the following spare parts for the screening system:
  .1 One (1) AISI 304L stainless steel compactor spiral.
  .2 One (1) dedicated toolbox for all spare parts listed with the exception of the wash press spiral.

.4 Provide any specialty tools required for maintenance.

1.6 QUALITY ASSURANCE

.1 Published equipment performance ratings for manufactured items to be based on physical tests carried out by the Manufacturer or an independent testing agency in accordance with accepted industry standards, or as specified. Conformance to codes and standards to be confirmed by an independent testing agency at supplier's cost if proper supporting evidence cannot be provided.

.2 Provide all equipment from Single Manufacturer where applicable.

.3 Manufacturers of screening and compacting equipment to be regularly engaged in production of equipment of type and size specified. Provide list of references with a minimum of 5-10 years of continuous operating experience demonstrating equipment use in similar installations.

.4 Guarding to meet OSHA and CSA Z432 requirements.

.5 All electrical installation and components shall comply with CSA and local electrical authority.

.6 Electrical Equipment not bearing a CSA label requires an ESA field approval.

.7 Where required by Authority having jurisdiction, equipment shall bear a ULC or UL label.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

.2 Following installation and initial checkout by the installation Contractor, the manufacturer is to provide a factory trained technician to commission the screening system.

.3 Screening manufacturer to provide a checklist of items to be completed by the General Contractor prior to beginning commissioning

.4 Factory Testing

.1 Factory test centralized control panel in conjunction with supplied local control panel and related process equipment in order to verify a complete and operation a system as well as related interlocks and operational sequencing prior to shipping. Network connectivity as well as PLC based monitoring and alarming shall be fully verified. Factory testing to be carried out in the presence of the Consultant.

.2 Controls and motors to be factory tested and reports are to be provided to the Consultant and the Owner prior to shipment of the equipment.

.5 Manufacturer's Services:

.1 Compactor PLC Control System Review Meeting: The Screening System supplier shall allow for three (3) meetings each four (4) hours on site to review and coordinate Screening Systems PLC control narratives, alarming, screen layouts, and remote monitoring over the construction of the new Screening System. These meetings are to be at the 60%, 90% and 99% programming completion stages.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 Training required for the compactor and associated appurtenances.

.3 Only following commissioning and acceptance of screen installation by Consultant, the factory technician is to provide training in the operation and maintenance of the equipment using the maintenance manual provided.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2– PRODUCTS

2.1 GENERAL

.1 Unless otherwise noted all headworks equipment to be designed to operate in an indoor location with a Zone 1 Group D electrical classification.

.2 Compacted screenings to be deposited into a chute leading to a waste container provided by others and to be suitable for disposal to landfill without any additional treatment or processing.

.3 Provide all instrumentation required for a complete and functional system, whether or not specifically shown on the Contract documents at no additional cost to the Owner.

.4 Refer to Section 17100 and Table of Devices for specific instrumentation requirements.

2.2 SCREENINGS COMPACTOR

.1 Description:
  .1 The wash press shall receive municipal screenings discharged by the screen, wash-off biological solids, and transfer screenings via a compaction tube to a hygienic bagger that is positioned above a receiving bin
  .2 The compactor will generally consist of an inlet hopper, perforated screw housing with drainage section, washing section, a dewatering and compaction section, a variable pitch screw, geared motor, and collection trough and discharge duct.
  .3 Provide complete factory assembled and tested unit consisting of a screw conveyor, collecting trough, washing system, discharge chute and drive assembly.
  .4 The unit is to be factory assembled and tested. Equipment shall be ready for installation and shall not require field assembly except where partial disassembly is required for transportation or protection of components.

.2 Operating Conditions:
  .1 Inlet feed rate: 2.0 m^3/h (±)
  .2 Efficiency: reduction in volume of up to 70% and dryness of up to 50% (weight).
  .3 Refer to the Drawings for layout and installation details.

.3 Screw Conveyor:
  .1 Abrasion Resistant Carbon Steel With HOBART type FABTUF 960 coating.
  .2 Screw shaft to be C-1020 Carbon Steel.
  .3 Minimum 195 mm compactor diameter.
  .4 The leading face of the last 1.5 flight section shall be provided with hard facing material.
  .5 A neoprene wiper blade shall be fastened to the periphery of each flight on both sides of each flight in the drainage section.

.4 Collecting Trough:
- .1 Fabricated of minimum 5 mm AISI 304L stainless steel.
- .2 Collecting trough to be a double trough construction.
- .3 Collecting trough to completely enclose the dewatering zone of the screw housing, equipped with a 75 mm drain connected to screen channel.

.5 Equipment Supports:
- .1 The discharge tube will be provided with floor supports that enable the removal of the first bend without the need for additional support for the remaining discharge tube. The supports shall retain the balance of the discharge tube in position when the first elbow is removed for inspection purposes.
- .2 Support structure to be constructed of 304 stainless steel.

.6 Washing System:
- .1 The washing system shall be designed to clean the collected material prior to the compaction zone, eliminate accumulation of material around the compaction tube drainage.
- .2 All washing, fluidization, and flushing systems shall be provided with 2-piece stainless steel ball valve isolation, slow closing, solenoid valves (suitably rated 120 V), and wye strainer complete with flushing valve.
- .3 Flushing water will be plant effluent water.
- .4 Refer to Section 15100 for additional valve requirements.
- .5 Refer to Section 15400 for additional strainer requirements.

.7 Discharge Chute:
- .1 Fabricated of minimum 1.5 mm AISI type 304L stainless steel.
- .2 Designed to discharge to the screenings disposal bin and prevent plugging with compacted screenings even at low loading rates.
- .3 Chute length from wash compactor to disposal bin to be verified by Contractor prior to fabrication.
- .4 Connection chute to be easily removable and connected by mechanical quick couplings.
- .5 Chute’s bends to be equipped with flanges to enable removal from wash compactor to facilitate inspection.

.8 Drive Assembly:
- .1 Provide an integrated drive assembly consisting of a parallel-helical gear drive.
- .2 Oil lubricated gear reducer shall include anti-friction bearings with high overhung load properties, and double lip high temperature oil seals riding on precision ground shafts. Conform to AGMA II, minimum S.F. of 1.4. The gear motor shall not be overloaded under any normal operating conditions and shall be designed for heavy-duty service.

.9 Bagging System
- .1 The bagging system shall provide a clean odour-free means of containing the solids discharged from the compactors outlet. A pleated plastic sleeve shall be fitted on the bag sleeve holder.
  - .1 The bagging system shall include a mounting adaptor fitted to the discharge chute, a bagging system assembly, bag, and fasteners.
  - .2 The mounting adaptor shall provide a smooth transition in diameter to the bagger system.

.10 Electrical
- .1 The motor shall be high efficiency totally enclosed, fan cooled (TEFC), designed in accordance with section 15053 motor specifications. Motor to be 2HP, 575 volt, 3 phase, 60 Hz. Motor to be constant speed and shall have a minimum 1.15 service factor and are to be Class I, Div. 1, Group D rated & CSA certified. Class F, insulation type (minimum) per Section 15053.
- .2 Provide all starters and drives necessary for a complete and operational system and are to be

located within a centralized screening system control panel (Electrical Room). All starters and drives provided shall conform with the requirements of Section 17051.

.11 Controls:
- .1 Washer Compactor to be equipped with a dedicated stainless steel NEMA 7 local control panel(LCP). LCP to be located near the screening and compactor equipment. Refer section 17051 for additional panel requirements.
- .2 LCP to include the following:
  - .1 HOA switch pilot.
  - .2 Forward/Off/Reverse selector switch with spring return to “Off”.
  - .3 Emergency stop button.
- .3 The following signals related to the Wash compactor are required between the Equipment Manufacturer’s Motor Starter Panel and PLC Panel:
  - .1 Wash compactor forward command (output).
  - .2 Wash compactor reverse command (output).
  - .3 Wash compactor in auto (input).
  - .4 Wash compactor running (input).
  - .5 Wash compactor running forward (input).
  - .6 Wash compactor running reverse (input).
  - .7 Wash compactor fault (input)
  - .8 Wash compactor disconnect open(input).
- .4 Provide the compactor with a current overload sensor consisting of current metering transformer and relay for mounting in the Screening System Control Panel. Screen manufacturer to calibrate and set protection limits before startup of the unit.
- .5 A “Jamming Cycle” shall be provided should the power requirement of the compactor exceed the preset point on the current monitor relay. The compactor to automatically reverse and forward the screw as required to clear the blockage. If the blockage cannot be cleared after 5 cycles, then the system to alarm on over current, and the compactor to be disabled.
- .6 Provide suitable time delay for current overload sensor on conveyor start-up.

.12 Specified Product:

.13 Alternatives:
- .1 Approved Equal.

2.3 MOTOR STARTER PANEL

.1 Electrical
- .1 All equipment and devices not located within the Centralized screening system control panel shall be rated for Zone 1(Class I Div 1) operation, within the Headworks facility area.
- .2 Provide all starters and drives necessary for a complete and operational Screening Removal system within the centralized screening system motor control panel. All starters and drives provided shall conform with the requirements of Section 17051.

.2 Controls
- .1 The motor starter control panel shall be a NEMA 12 painted steel control panel.
- .2 Motor Starter Control Panel to include the following, refer to section 17051 for acceptable components.
  - .1 Overload relays, contactors, power distribution blocks, control transformer, terminal blocks to terminate all field wiring.
  - .2 Operator interfacing devices to be located on the door of the panel. This includes but not limited to multi-position selector switches, pilot lights, lapse time meters, and push buttons.

.3 Wire/terminal block.
.4 Motor starters/drives.
.5 Miscellaneous control components

.3 Refer to the individual equipment sections above as well as the project P&ID's for required control interface.

.4 The panel enclosure will be equipped with an internal bonded steel divider that separates high 575VAC voltage components from lower 120VAC and 24VDC controls components.

.5 Refer to Section 17051 for further requirements of the motor starter control panel.

.3 Specified Manufacturer: Veolia.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Install Part 2 equipment in accordance with manufacturer's instructions.

.2 Provide anchor bolts, fasteners, washers, and templates required for installation of Compactor equipment.

.3 Equipment Supplier shall assist with the work of the Installation Contractor including but not limited to installation of the Compactor equipment components:
.1 All interconnecting control/power wiring.
.2 Verify all field wiring and PLC I/O connections made by Installation Contractor to their respective termination points.
.3 Inspect, test, and verify communications links from respective control panels, drives and equipment to plant SCADA.

3.2 FIELD QULAITY CONTROL

.1 General:
.1 Compactor Equipment Supplier shall complete Manufacturer's Certificate of Proper Installation upon satisfactory installation of Fine Screening and Washer/Compactor equipment.
.2 Refer to Division 1 for testing requirements.
.3 Compactor Equipment Supplier shall calibrate instruments, sensors, and meters supplied for testing.
.4 Instrumentation and Controls Testing: After installation of the Compactor equipment and prior to commissioning, the Equipment Supplier, in coordination with the Contractor, shall test all instrumentation and control function and verify conformance with approved sequence of operation and system documentation. The Contractor shall also coordinate Equipment Supplier and the system Integrator to test all interface signals and interlocks between Screening, Compactor Control Panels, drives, local control panels, and the plant-wide SCADA system over the Ethernet Network.

.2 Functional Testing:
.1 Functional testing shall be conducted after the installation of the Compactor equipment and all appurtenances is complete, to verify proper operation of all the equipment and controls under wet-run conditions using plant water for Compactor feed. Each complete unit shall be subject to field functional tests under wet-run conditions to determine that operation is satisfactory.
.2 The Equipment Supplier, in coordination with the Contractor, will provide all temporary measures required for the functional tests. Written test procedures shall be submitted to the Consultant for approval a minimum of 60 days prior to testing.

.3 The functional tests shall determine the characteristics of each unit and demonstrate the units:
.1 Have not been damaged by transportation or installation.
.2 Have been properly installed.
.3 Have no mechanical defects.
.4 Are in proper alignment.
.5 Have been properly connected.
.6 Are free of overheating of any parts.
.7 Are free of objectionable vibration and noise as specified.
.8 Are free of overloading of any parts.
.9 Are properly lubricated.
.10 Respond properly to all start-up and shutdown sequences.

.3 Vibration Test: Vibration testing shall be conducted during field functional testing. The Equipment Supplier shall verify operations are within tolerances and the vibration signature recorded over the frequency domain.
.1 Provide vibration signature test data for each piece of equipment and drive assembly to meet performance requirements specified.
.2 Test Duration: Refer to Section 15010.

.4 Noise Test: Perform noise testing in the field with equipment installed and operating at peak capacity to verify noise produced by the equipment. Noise from equipment to be less than or equal to those listed by the manufacturer.

END OF SECTION

PART 1 – GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This section provides details for the fabrication, supply and installation of flapgates, slidegates, and handgates.

1.2 REFERENCES

.1 The following is a list of standards that may be utilized in this section. Unless specifically noted otherwise, the reference indicated shall be the latest standard adopted by the regulatory agency as of the tender date.
- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .2 ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
  - .3 ASTM A380 – Standard Practice for Cleaning, Descalling & Passivation of Stainless Steel Parts
  - .4 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .5 ASTM B308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
  - .6 ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
- .2 American Water Works Association (AWWA):
  - .1 AWWA C561 – Fabricated Stainless Steel Slide Gates.
  - .2 AWWA C542 – Electric Motor Actuators for Valves and Slide Gates.
  - .3 AWWA C513-: AWWA Standard for Open-Channel, Fabricated-Metal Slide Gates
- .3 American Bearing Manufacturers Association (AFBMA).
- .4 American Iron and Steel Institute (AISI).
- .5 American Gear Manufacturers Association: (AGMA).
- .6 American National Standard Institute: (ANSI).
- .7 Canadian Standards Association: (CSA).
- .8 Canadian Electrical Manufacturers Association: (CEMA).
- .9 National Electrical Manufacturers Association: (NEMA).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15 requirements

.2 Informational submittal required for all Part 2 – Products specified herein.
- .1 Product Data to be provided in addition to the requirements noted above:
  - .1 Make, model and identification tag consistent with the project P&ID for the gate.
  - .2 Detailed installation instructions including any block-out requirements.
  - .3 Provide coating details.
- .2 Operation and Maintenance Data:
  - .1 Operation and Maintenance Manuals. Refer to Division 1 for requirements.
  - .2 Manufacturer’s installation requirements
- .3 Quality Control Data to include:
  - .1 Certified documentation from the manufacturer indicating compliance with the specified standards.
  - .2 Calculations stamped by an engineer licensed in the province of Ontario confirming that gates and their installation meet the requirements of the OBC Part 4.

.3 Installation certificate from the manufacturer or its representative confirming proper installation.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 Maintenance and Spare parts to be in accordance with Division 1 requirements

.2 Contractor shall verify and demonstrate that proper maintenance can be performed on equipment and material installed.

.3 Provide any specialty tools required for maintenance.

1.6 QUALITY ASSURANCE

.1 Ensure supplied gates conform to the referenced standards specified herein.

.2 Provide all equipment from Single Manufacturer where applicable

.3 All electrical installation and components shall comply with CSA and local electrical authority.

.4 Provide factory testing of Flap Gates to ensure that there is proper contact between the flap gate, the cover, and the frame. Parts to exclude a 0.10mm feeler gauge.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 Mechanical General Provisions.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 Mechanical General Provisions.

PART 2– PRODUCTS

2.1 GENERAL

.1 Refer to drawings and slide gate schedule for sizing and other requirements for individual gates.

.2 All gates to be tagged per the P&ID drawings and per the requirements of Section 15020.

.3 Provide lifting lugs on all gates.

.4 Performance:
.1 Design seating/unseating heads as scheduled.
.2 Leakage rate for general service slide gates:
.1 Under seating head conditions to be a maximum of 0.60 L/min. per metre of seal periphery.
.2 Under unseating head conditions less than 6 m to be a maximum of 1.25 L/min. per metre of seal periphery.
.3 Under unseating head conditions greater than 6 m to be defined as follows:
.1 1.25 + 0.1025 x (head-6.1).
.3 Leakage rates for high performance slide gates to be true zero leakage.

.5 All gates shall be complete with any guides, frames, floor stands, brackets, wall thimbles (where specified), stems, actuators, and any other appurtenances for a complete and functioning installation.

.6 All stainless steel gates to be pickled and passivated in accordance with ASTM A380.

2.2 HIGH PERFORMANCE FLAP GATES

.1 Gates to be high performance where indicated in the schedule.

.2 Gates to be capable of passing raw sewage with entrained solids, rags, and grit. The gate is to close full and seal tight at the end of the open operation.

.3 Frame/Guide:
.1 Fabricated of ASTM A276 Type 316 stainless steel.
.2 Frame to be flange back design suitable for mounting on the end of a flanged pipe.
.3 The angle of the flap when seated against the frame shall not be less than 3 degrees from the vertical.

.4 Hinge Arms
.1 Dual hinge arms to be constructed of ASTM A276 Type 316 stainless steel, and shall connect the frame to the flap.
.2 The top pivot shall allow adjustment of the gate alignment.
.3 The gate shall be provided with an adjustable, double pivoted hinge linkage designed to permit complete seating and stops to prevent the cover from becoming wedged in the open position.
.4 The hinge pins shall be constructed of a solid ASTM A276 Type 316 stainless steel bar.

.5 Flap:
.1 The flap shall not deflect more than 1/360 of the span under the maximum design head.
.2 The flap and reinforcing stiffners shall be fabricated of ASTM A240 Type 316 stainless steel.
.3 The Reinforcing stiffeners shall be welded to the flap.
.4 A lifting lug shall be provided on the bottom of the flap.

.6 Seating:
.1 The perimeter of the gate shall be sealed with a resilient replaceable neoprene seal.
.2 Flap gates to be provided with a continuous resilient J type seal mounted to the seating surface of the frame to restrict leakage.
.3 The seals shall be held in place by stainless steel retainer and attachment bolts.

.7 Specified Product: BNW Series .

.8 Alternate Manufacturers:

.1 Approved Alternate.

PART 3– EXECUTION

3.1 APPLICATION

.1 Compliance: comply with Manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and datasheets.

3.2 INSTALLATION

.1 Handle and install gates following manufacturer’s written instructions.

.2 Provide equipment identification tags on all gates and stop logs consistent with the P&IDs and in accordance with Section 15020.

3.3 TESTING

.1 Refer to Division 1 for testing requirements.

END OF SECTION

PART 1– GENERAL

1.1 GENERAL

.1 Contractors, supervisors, and tradesmen performing work in this Division must be experienced and qualified to undertake the works. Experience in the municipal water/wastewater treatment or industrial sector is necessary.

.2 Mechanical Contractor's foreman to have several years of experience in similar municipal water or wastewater or industrial plant construction work of a similar scope.

.3 Unless otherwise noted, all requirements of Division 15 apply to Division 11.

1.2 CONTRACTOR QUALITY ASSURANCE PROGRAM

.1 The Contractor is solely responsible for the quality control as specified in Division 1.

1.3 DOCUMENT REFERENCES

.1 These specifications are an integral part of the Contract Documents. Refer to other Sections to ensure a completed operational product and fully coordinated standard of work.

.2 Review specifically Division 1 for requirements that may pertain to the work in this Section.

.3 "Provide" in Divisions 11 and 15 means to "supply and install".

.4 Conform to Canadian Metric Practice Guide CSA CAN3-Z234.1-00.

.5 Provide all required adaptors between "metric" and "Imperial" installations.

.6 Metric descriptions in this Division are nominal equivalents of Imperial values.

1.4 COMMISSIONING

.1 Refer to Division 1. Division 1 could include clauses that have significant financial impact. Review carefully and advise all subcontractors and suppliers.

.2 Supply complete instruction and information relating to the operation and maintenance of all equipment and systems.

.3 Deliver a system which performs in accordance with the contract documents and equipment manufacturer's requirements.

1.5 PROJECT SCHEDULE

.1 Refer to Division 1 for additional scheduling requirements.

.2 Refer to Division 1 for additional project phasing and sequencing requirements

1.6 PROGRESS PAYMENTS

.1 Refer to Division 1.

1.7 DRAWINGS AND MEASUREMENTS

.1 Drawings do not indicate exact architectural, structural or electrical features. Examine drawings prior to laying out, fabricating and installing work to ensure no interference exists. Report conflict with work to Consultant before proceeding.

.2 Drawings show general design and arrangement of mechanical system installation and are diagrammatic in some details. Coordinate all drawings and with all trades for complete operational system. Make modifications to mechanical layouts where minor interferences occur at no cost to Owner. Be prepared to make minor relocations to position and orientation of equipment at no cost to Owner.

.3 Do not scale drawings to order material. Take field measurements before ordering materials and make material conform to site conditions.

.4 Routing and elevations of small diameter piping is somewhat diagrammatic. Contractor to plan final installation and review with Consultant prior to installation. Consideration to be given to following building and piping lines, maximize available headroom, avoid interference with equipment and other piping, avoiding unnecessary offsets and fittings.

.5 Provide additional field drawings with position of various services when required by Consultant.

.6 Indicate distance from column lines and pipe elevations. Show all interference drawings to piping, lights, cable trays and electrical wiring runs. Consultant will provide AutoCAD format drawings if requested.

.7 Where drawings and/or specifications conflict advise and cooperate with Consultant to resolve issues.

.8 Submit sketches clearly indicating proposed rerouting of piping and/or relocation of equipment for approval prior to installation.

.9 All costs incurred as a result of interferences not identified prior to installation are to be borne by Contractor.

1.8 AS-CONSTRUCTED DRAWINGS

.1 After award of Contract, the Contractor will print and maintain a full size a set of white prints for the purpose of maintaining As-Constructed Drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and change orders. Record changes in same scale and quality of original drawings.

.2 Identify all revisions made to contract drawings and reference fabrication drawings included.

.3 Changes to be performed by qualified drafting personnel.

.4 Record locations of concealed components of mechanical and electrical services. Photograph concealed locations and submit As-Constructed Drawings.

.5 Record elevation of major piping and dimensions from nearest column line or reference point.

.6 Update schedules with equipment and equipment models supplied.

.7 Identify drawings as "Project Record Copy". Maintain in new condition and update regularly.

.8 On completion of work and prior to final inspection, submit record documents to Consultant.

.9 Refer to Division 1 for additional requirements.

1.9 INTERRUPTION OF EXISTING SERVICES

.1 Refer to Division 1 for additional requirements.

.2 Plan work in order that unknown or hidden services are identified several days in advance of the related project work.

.3 Immediately advise Consultant when unknown services are encountered and await instructions. Proceed with any emergency measures if required.

1.10 REMOVAL AND REUSE OF EXISTING MATERIALS

.1 Identify to Owner at least 72 hours in advance existing material and equipment to be removed from work but not identified for re-use on-site to Owner/Others. Acceptance of removed material and equipment is at discretion of Owner. Where deemed unsuitable, remove such items from site. Otherwise move to location on-site designated by Owner.

.2 Equipment to be relocated is to be removed and relocated by Contractor in an as found condition. Contractor is responsible for temporary storage of equipment. Document as found conditions prior to removal.

.3 All demolished piping is to be removed from the site and disposed of in accordance with Division 1 and Division 15 requirements.

.4 Materials to be salvaged are itemized in Division 1.

1.11 RELATED WORK

.1 Assume full responsibility for laying out work and for any damage caused to Owner's or other trade property by improper methods or location of equipment.

.2 Concrete bases for mechanical work: Division 3.

.1 Locate and size bases, supply and set equipment anchor bolts in place: Division 15.

.3 Cutting, patching and reinforcing openings cut for mechanical work: Divisions 3 & 5.

.1 Co-ordinate location and size for mechanical openings: Division 15.

.4 Repairing walls and floors following mechanical demolition: Division 3.

.5 Sealant installation (except Link-Seal) for mechanical pipe and duct sleeves through walls and floors:

Divisions 1 & 7.

.6 Painting mechanical equipment, ductwork, piping: (except specified with a factory finish), unless indicated otherwise: Division 9.
  .1 Standards for mechanical identification painting: Division 15.
  .2 Standards for paint and application Division 9.

.7 Installation of instrumentation requiring insertion or direct connection to piping, tanks or equipment: Division 15.

.8 Isolation of piping, flushing, and cleaning to permit tie-ins: Division 15.

.9 Installation of tubing to connect analyzers and instruments: Division 15.

.10 Installation requirements for Instrumentation: Division 17.

.11 Request details for installation of Instrumentation and Analyzers: Division 15.

.12 Wiring of instrumentation: Division 17.

.13 Coordinate all wiring requirements with Division 16.

.14 Installation and alignment of electric motors and equipment: Division 15.

.15 Wiring and testing of electric motors: Division 16.

.16 Installation and Commissioning of HVAC control components and wiring: Division 16.

.17 Supply of HVAC control components, specified in individual sections. Division 15.

.18 Installation of underground piping between buildings. Division 2.

.19 Trenching and backfill for underground pipe piping between buildings. Division 2.

1.12 COOPERATION WITH OTHER TRADES

.1 Review all contract documents and coordinate with work of other Divisions.

.2 Co-operate fully with Division 16 to lay out location of ducts, piping and lighting fixtures in areas where in close proximity to each other.

.3 Report areas of conflict immediately to Consultant in writing for comment. Do not continue work until corrective measures are prescribed. Site reports to be issued on a standard form and be numbered sequentially and dated.

1.13 PROTECTION OF WORK

.1 Protect all finished and unfinished work from damage. Protect bearings, seals, glands, shafts of rotating equipment. Cover floors and other work with tarpaulins where required.

.2 Cap all equipment connections until piping connections are made. Cover all equipment in construction areas with tarps and protect from damage.

.3 Repair damage caused to surfaces of building without cost to the Owner and to satisfaction of Consultant.

.4 Be responsible for condition of all materials and equipment supplied and/or installed. Provide protection prior to, during and after installation until takeover by Owner.

.5 Store all equipment indoors at all times. Provide temporary storage as required.

.6 Replace all damaged materials without cost to Owner and to satisfaction of Consultant. Repairs to damaged equipment or components will not be accepted.

1.14 TEMPORARY AND TRIAL USE

.1 Obtain written permission from Consultant to use and test permanent equipment and systems prior to Substantial Performance.

.2 Consultant may use equipment and systems for test purposes prior to acceptance. Provide labour, material and instruments required for testing. Rectify incomplete work immediately to satisfaction of Consultant.

.3 Protect equipment and system openings from dirt, dust and other foreign materials during temporary usage. Cover all pipe and equipment openings.

.4 Clean and renew equipment and system used prior to acceptance.

1.15 PRE-COMMISSIONING COMPONENT AND SYSTEM TESTS

.1 Refer to Division 1 for additional commissioning details.

.2 Original equipment manufacturer to submit equipment start-up procedures and requirements prior to start-up.

.3 Perform systematic check, test components in all systems, ensure that each system functions correctly before commencing balancing work.

.4 Provide all primary elements, test wells, tappings, valves, etc. required for testing.

.5 Provide isolation valves on all instrumentation and vents and all devices which require isolation during testing due to high pressures.

.6 Check motors for smooth operation throughout their entire range.

.7 Check seals on pumps and packing on valves.

.8 System Check List (if applicable):
- .1 Complete lubrication of equipment. Following initial start-up, drain lubricants and replace.
- .2 Complete system start-up.
- .3 Adjust stuffing boxes and packing glands on pumps and valves.
- .4 Verify rotation of electric motors and ratings of overload heaters.
- .5 Adjust rotating equipment alignment and belt drive tension.
- .6 Check safety and operating control set points and automatic control sequences with design

requirements. Verification to be functional by instituting actual operating conditions or simulating the same. Jumpering of contacts to simulate an alarm, for example, will not be accepted.

.7 Clean up installation and temporary coverings, remove stickers and tags.

.8 Touch up painted finishes where damaged.

.9 Complete equipment and piping identification work with valve tags, schedules and piping identification system.

.10 Check list of Startup Procedure (each system).

.1 Pre-startup Inspection:

.1 Verify proper equipment mounting and setting.
.2 Verify that control, interlock and power wiring are correct.
.3 Verify alignment of motors and drives.
.4 Verify proper piping connections and accessories.
.5 Verify that lubrication is complete.

.2 First Run Observation:

.1 Verify direction of rotation.
.2 Verify setting of safety controls.
.3 Monitor heat build-up in bearings.
.4 Check motor loads against nameplate.

.3 Equipment Check List:

.1 Verify proper overload heater sizes.
.2 Verify function of safety and operating controls.
.3 Verify proper operation of equipment.
.4 Report on inspection, observation and checking procedures.

1.16 ALIGNMENT AND VIBRATION

.1 As part of the pre-commissioning process, following start-up and acceptance of installation by manufacturer`s representative, field check alignment of all drives and drives and clearance on couplings. Complete laser alignment. Measure vibration through full range of frequencies using independent millwright or testing agency. Record measured alignment tolerances and vibration measurements. Submit report and complete recommendations for the following equipment:

.1 All Raw Sewage Pumps.
.2 Screenings conveyor / Screen

.2 Verify alignment of drives and belt tension for all belt driven equipment.

.3 Verify bearing temperatures after four (4) continuous hours of operation.

.4 Alignment and vibration analysis, in addition to other verification items above, to be completed by experienced millwright firm regularly involved in this work. One firm is to be used for all equipment on site unless otherwise approved. Analysis to be performed in cooperation/consultation with the equipment manufacturer’s representative.

.5 Acceptable companies:

.1 Nesbitt Engineering.
.2 Hewitt (Brockville).
.3 Alternates approved by Consultant during Tender period.

1.17 LUBRICATION

.1 Coordinate with equipment suppliers to:
  .1 Provide initial lubrication of equipment.
  .2 Provide initial fill of lubricating and transmission oils.
  .3 Replace all lubricating and transmission oils used at start-up within 14 days of substantial performance.

1.18 OPERATING AND INSTRUCTION MANUALS

.1 Furnish Consultant with operation and maintenance manuals in accordance Division 1 and section 15014 requirements

.2 Operation and Maintenance Manuals are considered necessary for the operation of the equipment and must be submitted prior to substantial performance.

1.19 TRAINING

.1 Refer to Division 1 and individual specification sections for additional Training requirements

.2 Instruct operating staff in maintenance, adjustment and operation of mechanical equipment. Training provided before equipment and related system has been successfully proven will not be acceptable.

.3 Provide instruction during regular work hours.

.4 Notify Consultant of instruction period and await written notice to proceed.

.5 Use operation and maintenance data manual and updated As-Constructed Drawings for instruction purposes. All information provided at training session is to be documented and included in manuals.

.6 Review teardown and overhaul requirements using information included in manuals.

.7 Instruct staff on changes made under terms of warranty or modification of equipment.

.8 Document training dates and have each person in attendance sign off on training record sheet.

1.20 PERFORMANCE DOCUMENTATION

.1 Competent representative of manufacturer to thoroughly inspect equipment before submitting same for Substantial Performance and certify in writing as complete, installed in accordance with installation instructions and operating correctly.

1.21 WARRANTY:

.1 Refer to Division 1 and individual specification sections for additional warranty requirements.

1.22 CLEANING

.1 Do not operate equipment until systems are clean.

.2 Remove all debris from inside mechanical equipment, ductwork and piping systems.

.3 Vacuum clean inside duct systems.

.4 Flush piping system thoroughly with water to remove sediment and debris in accordance with Section 15083.

.5 Prior to connecting to on-line potable water systems directly or isolated by a valve, systems must be disinfected in accordance with Division 1.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 – EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Refer to Division 1 for additional demolition requirements.

.2 Clearly identify materials and equipment to be removed, retained or to remain in place prior to commencement of work. Complete walkthrough with Consultant and Owner. Physically mark items for, and extent of, demolition and document scheduling and constraints.

.3 Dispose of demolished material except where specifically noted otherwise on the drawings and as listed in Division 1.

.4 Where existing materials are to be turned over to the Owner, be responsible for removal and delivery to Owner on site. Load on pallets for transportation by Owner. Clean equipment for storage.

.5 Where existing materials are to be reused be responsible for removal, storage, cleaning and reinstallation.

.6 Where portions of existing systems are to be demolished, coordinate work to maintain operation of remainder of system.

1.2 EXISTING CONDITIONS

.1 Take over structures and equipment to be demolished and removed based on their condition at the time of examination during tender period.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3- EXECUTION

3.1 DEMOLITION

.1 Prior to undertaking any demolition or other work, Contractor to review the Designated Substances Survey and complete any required abatement.

.2 Complete demolition of systems and equipment as indicated on the drawings.

.3 Demolish complete or partial mechanical systems to accommodate construction and remedial work as indicated.

.4 Temporarily remove existing equipment, services, and obstacles where required to complete the new work and replace same as work progresses.

.5 Maintain adequate structural support during removal of equipment and material.

.6 Cap existing systems at point of disconnection except where detailed. Cut back pipe into wall and grout per detail on drawing.

.7 Dispose of demolished materials and equipment identified for removal unless indicated otherwise.

3.2 PIPING DEMOLITION

.1 Recognize that most process piping systems subject to removal have not been decommissioned.

.2 Include for flushing chemical piping to a sanitary drain and at a rate acceptable to plant operators.

.3 Include for flushing and/or pigging of sludge lines to permit removal from site and disposal. Flush contents and pump to a location acceptable to operators.

3.3 PREPARATION

.1 Disconnect and cap mechanical services to be abandoned or services to abandoned equipment as indicated on drawings. Identify all services prior to abandonment or removal. Services to be capped to standards of new piping and/or ductwork specifications in this Division.

.2 Do not disrupt active services for other facilities.

.3 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interior of parts not to be demolished from exterior elements at all times.

.4 Demolish in a manner to minimize dusting. Keep dusty materials wetted.

.5 Remove contaminated or dangerous materials from site and dispose of in safe manner to minimize danger at site or at any time during disposal.

3.4 RESTORATION

.1 Restore existing work damaged due to this work to a condition equal to that before work began and to satisfaction of Consultant.

3.5 EQUIPMENT SALVAGE

.1 Refer to Section 15010 and Division 1.

END OF SECTION

PART 1- GENERAL

1.1 BINDER DETAIL

.1 Refer to Division 1 and individual equipment specifications for additional requirements.

.2 Binders must be clearly and permanently identified on spine and front with project name and number and specific binder contents. Any material larger than 8½ x 11 (i.e., folded prints) will be inserted into appropriate size and properly reinforced plastic pouches with flap to top of binder. Fit into the binder rings and contents clearly identified on front and back. Drawings not to be punched for rings.

.3 Manual to be submitted prior to requesting initial start-up.

1.2 ORGANIZATION

.1 Refer to Division 1 additional requirements.

.2 Organize binder by specification section. Provide tabs for each section and subsections.

.3 Prepare detailed index referencing tabbed section numbers.

.4 Include list of suppliers and contacts at front of section.

1.3 INFORMATION DETAIL

.1 Only pertinent detail is acceptable. Full pages taken from suppliers' catalogues pertaining to a full range of equipment is not acceptable. Only totally legible photocopies may be used. All chapters must be identified by tabs.

.2 Information should be divided into the following categories described in more detail in1.4 below.

Operation	-	Concept of operation
Equipment	-	Detail of components used
Maintenance	-	Troubleshooting techniques
	-	Lubrication requirements
Spare Parts	-	On-Site stocking requirements
Start-up Reports	-	Detailed start-up reports and measured start-up parameters
Warranties	-	Outline of coverage dates

1.4 CATEGORY DETAIL

.1 Outline of system function giving:
- .1 Step-by-step start-up procedures.
- .2 Step-by-step shutdown procedures.
- .3 Emergency shutdown procedure.

.4 Adjustment sequencing.
.5 Start-up set points.
.6 Valve charts.

.2 Equipment
.1 All pertinent detail preferably in chart form.
.2 Tag number indicated in Contract documents.
.3 Review drawing number.
.4 Model, part number and serial number.
.5 Contract and specification number.
.6 Wiring diagrams reduced to 280 x 430 format.
.7 Reviewed drawings - as-builts, including applicable specification number.
.1 All wiring and loop diagrams to be reduced to 250 x 430 format.
.8 Exact motor nameplate data summarized on a single sheet for each piece of equipment and verified in the field.
.9 Complete parts diagram and assembly drawing listing all part numbers.
.10 Complete information to complete teardown maintenance including assembly and torquing requirements.
.11 Provide 1 valve list (in plastic covers) for each Operation and Maintenance Manual.

.3 Maintenance
.1 Lubrication (acceptable products and schedules)
.2 Troubleshooting procedures.
.3 Adjustment techniques.
.4 Operational checks.
.5 Provide one (1) page summary of daily/weekly/ monthly/yearly maintenance for each piece of equipment.

.4 Spare Parts
.1 List of recommended spares to be maintained on-site to ensure optimum efficiency.
.2 List all special tools and appropriate unique application.
.3 Detail manufacturer and supplier names and addresses.
.4 All equipment is to be listed as to types.

1.5 ELECTRONIC FORMAT DATA

.1 Each manufacturer is to provide maintenance information in hardcopy for the binders and as PDF format files.

1.6 WARRANTIES

.1 List contacts for warranty rectification.

.2 Copies with seal and signature of Contractor of all registration certificates, specifically pressure vessels; permits, approvals, etc.

.3 Detail all warranty periods.

1.7 MECHANICAL ROOM

.1 Frame and hang one copy in each respective area of the following (copies to be included in manual):
  .1 Valve Tag List and copy of Process Flow Diagram.
  .2 Pressure vessel certificates.

.2 Mounting in framing to be suitable for long term exposure to a high humidity environment.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Includes, but is not limited to:
- .1 Painting of mechanical equipment, piping, supports, etc.: Division 9, Section 09900.
- .2 Coordination of painting requirements, colour requirements, etc. for mechanical piping and equipment: Divisions 11 and Division 15.
- .3 Manufactured secondary colour marking bands, arrows, lettering: Division 15.

.2 Refer to individual specification sections for additional coating and tagging requirements.

1.2 SYSTEM DESCRIPTION

.1 Provide identification system for piping, valves and equipment.

.2 Identification to consist of colour codes, valve tags, equipment and system nameplates, lettered identification, schedules.

1.3 QUALITY ASSURANCE

.1 Piping Systems: CGSB 24-GP-3a

1.4 SUBMITTALS

.1 Submit following for review by Consultant, at least 2 weeks prior to ordering material:
- .1 Legend and colour classification for material not listed in table or changed from table.
- .2 List of equipment nameplates.
- .3 Submit type of markers to be used and corresponding material upon which marker is to be applied to, including sample installations.

PART 2 - PRODUCTS

2.1 VALVE SCHEDULE

.1 Provide 1 valve list (in plastic covers) for each Operation and Maintenance Manual.

.2 List tag schedule designating number, service, function, and location of each tagged item. Identify normal operating position of valves.

2.2 EQUIPMENT MANUFACTURER'S IDENTIFICATION

.1 Equip each piece of equipment with stainless steel manufacturer's nameplate. Submit nameplate data to Consultant. Use raised or recessed letters. Fasten mechanically. Identification to include the following (as applicable):

- Model number
- Serial number
- Capacity
- Head
- Impeller diameter
- Efficiency
- Performance rating
- Year of manufacture
- Other information required to uniquely identify the equipment
- Performance data in S.I. metric units
- CSA approval

Record exact nameplate data and include on a separate sheet for each piece of equipment in maintenance manual. Insert sheet in O&M Manual.

.2 Provide registration plates (pressure vessel, UL, ULC, CSA approval) as required by respective agency. Indicate equipment model, size, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.3 PIPE MARKERS

.1 Standard of Acceptance: Brady Type B-946.

PART 3 - EXECUTION

3.1 PIPING AND VALVES

.1 All new exposed ferrous piping, other than stainless steel, to be primed and painted in accordance with Division 9 standards and as listed herein. Exposed piping is considered to be uninsulated or unenclosed piping.

.2 Pipe 40 mm and larger: provide Brady Type B-946 vinyl coated pressure sensitive tape as listed below. Provide alphabetic identification and directional arrows where applicable. Use Type B.946 vinyl tape for outdoor piping. Use Type B-500 vinyl coated cloth tape where surfaces are not smooth (i.e., uninsulated ductile iron pipe). Each marker to be one continuous piece and include entire label name.

Paper Size	Character Height	Character Line Width	Symbol Line Width
75 mm and larger	40 mm	12 mm	40 mm
40 to 65 mm	25 mm	8 mm	20 mm
ducts	64 mm	12 mm	40 mm

.3 Pipes smaller than 40 mm: provide Brady Type B-946 pressure sensitive vinyl tape. Identification to have minimum 10 mm high letters.

.4 Provide manufacturer's banding tape at each end of pipe marker. Band to be applied to go around pipe a minimum of two passes. Use directional arrow banding tape where applicable. Adhesives on all markers and bands to be suitable for use on respective mounting surfaces and environments. Use double headed arrows where flow is reversible.

.5 Provide rectangular polished aluminum tags on pipe and tubing smaller than 12 mm in diameter. Tags to be 1.5 mm thick and 19 mm wide. Provide 6 mm clear of characters at both ends of tags. Black characters to be minimum 12 mm high with 2 mm character line width.

.6 Piping markers to be in accordance with Identification Colours Table.

.7 Locate markers and classifying colours on piping so they can be seen and identified from normally accessible locations on floor or platform.

.8 Do not exceed 6.0 m between identification.

.9 Identify piping on both sides of equipment.

.10 Identify both sides where piping passes through walls, partitions and floors or is concealed in pipe chase, gallery or other confined space.

.11 Identify piping at all valves immediately upstream of valves.

.12 Identify services in full except in cases of limited space. Avoid single letter abbreviations.

.13 Check colour classification in table with respect to environment, location and service.

.14 Identify piping at branch fittings.

.15 Identify piping at end of every run.

.16 Paint entire length of exposed ferrous piping. Paint in accordance with colours listed in Identification Colours Table.

.17 Paint all new and existing valves in service areas. Paint valve handles yellow.

.18 Provide tags for valves connected by a chain to the valve handle. Attach one tag to the valve and one tag to the chain operator in a location readily visible to the operator.
- .1 Indoor tags to be engraved 2 ply plastic laminate.
- .2 Outdoor tags to be engraved brass tag, minimum 50 mm.

.19 Tag all new valves and existing process valves per the P&ID and MID drawings.

.20 Review list of system nameplates, tags and duct identification with Consultant prior to engraving.

3.2 VALVE SCHEDULE

.1 Number system valves as indicated on drawings. Provide individual schedule for each building and area.

3.3 EQUIPMENT

.1 Locate nameplates for easy identification.

.2 Do not insulate or paint over plates.

.3 In addition to metal manufacturers nameplates provide laminated plastic plates with black surface

and white centre, 90 mm x 40 mm x 2.5 mm nominal thickness. Engrave with 12 mm high lettering. Identify major equipment and tankage with 25 mm high letters. Fix to equipment mechanically. Where not practical to fix to equipment, fix to adjacent surface

.4 The following factory painted equipment is to be re-painted in accordance with section 09900
.1 All new and existing raw sewage pumps.

3.4 MANUFACTURED MARKERS

.1 Use pre-manufactured mechanical snap-on bands in primary colour only when proper pipe surface quality cannot be obtained for secondary band and lettering identification application.

3.5 WARRANTY

.1 Replace or repair all identification markers in disrepair 12 months after substantial performance.

3.6 SPARES

.1 Provide the following:
.1 Six (6) spare pipe markers for each piping service.
.2 Allow for 12 valve tags and marking as directed by the Consultant.

3.7 SUPPLEMENTS

.1 Identification schedule included at the end of this section.

END OF SECTION

Table: Identification Colours

"Note: This list is generic, not all services or systems may be included in this project."

SYSTEM IDENTIFIER		PIPE MARKERS		PIPE PAINTING		
		Colour of Background	Colour of Legend/Arrow	Pipe Colour	CGSB Colour Code	ICI Paint Code
BYP	BYPASS	Per related media		PER RELATED MEDIA		
DR	DRAIN (PROCESS)	Y	B	LIGHT BROWN	504-107	00 YY 43/304
AL	ALUM	Y	B	FANTASIA	511-104	DC 9600 Safety Purple
RSE	RAW SEWAGE	Y	B	MID GREY	501-103	30 B6 12/027
CND	CONDENSATE	G	W	BLACK		DC 9990 Black
DWV	DRAIN/WASTE/VENT	Y / VENT: BLUE	B / VENT: WHITE	BLACK / TBD	512-101	DC 9990 Black
HWR	HEATING WATER RETURN	G	W	LIGHT GREY	501-108	30 6Y 33/051
HWS	HEATING WATER SUPPLY	G	W	LIGHT GREY	501-108	30 6Y 33/051
NG	NATURAL GAS	Y	B	YELLOW ORANGE	508-103	DC 9200 Safety Orange
OF	OVERFLOW	PER RELATED MEDIA		PER RELATED MEDIA		
RL	REFRIGERANT LIQUID	Y	B	YELLOW ORANGE	508-103	DC 9200 Safety Orange
RS	REFRIGERANT SUCTION	Y	B	YELLOW ORANGE	508-103	DC 9200 Safety Orange
SAN	SANITARY DRAIN	Y	B	MID GREY	501-103	30 B6 12/027
VENT	VENT	B	W	TBD		

END OF SECTION

PART 1- GENERAL

1.1 GENERAL

.1 Test systems after installation but prior to concealment and final placing of equipment.

.2 Conduct tests in presence of authority having jurisdiction, Commissioning Team, and Consultant.

.3 Isolate all instrumentation, vents and other devices from system which may be subject to damage due to high test pressures.

.4 Where new work connects to an existing piping system, isolate and test new work. Make final connection and use alternative procedure to verify integrity of final connection, i.e., X-ray or approved alternative procedure.

1.2 SUBMITTALS

.1 Submit notice of tests to Consultant a minimum of 3 business days prior to test being performed.

.2 Submit report, listing all mechanical tests performed, to Commissioning Team and Consultant for review prior to Substantial Performance. Report to include single line schematic type sketch indicating extent of test section, test pressure, duration, etc.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Provide equipment, pumps, compressors, accessories to conduct tests using non-potable water.

.2 Provide gauges calibrated by independent agency normally performing this service. Submit gauge calibration certificate.

PART 3 – EXECUTION

3.1 TESTING

.1 Testing requirements noted in table below:

SYSTEM IDENTIFIER		DESIGN PRESSURE (kPa)	TEST PRESSURE (kPa)	TEST DURATION (hours)	TEST TYPE (H) (P) (O)	NOTES
PROCESS						
RSE	Raw Sewage	215	450	2	H	
OF	Overflow		70	2	H	
DR	Drain		70	2	P	
CHEMICALS						
AL	Aluminum Sulfate	400	600	2	H	
BUILDING MECHANICAL						
CND	Condensate		70	2	H	
DWV	Drain/ Waste/		70	2	H	

SYSTEM IDENTIFIER		DESIGN PRESSURE (kPa)	TEST PRESSURE (kPa)	TEST DURATION (hours)	TEST TYPE (H) (P) (O)	NOTES
	Vent					
HWR	Hot Water Return	414	750	2	H	
HWS	Hot Water Supply	414	750	2	H	
NG	Natural Gas	35		2	P	1
RL	Refrigerant Liquid	2880	3100	2	O	2
RS	Refrigerant Suction	895	1600	2	O	2
SAN	Sanitary Drain		70	2	H	

NOTES:

General:

- For yard piping refer to Division 2 requirements.
- All testing procedures to comply with ASME B31.3 (Process and Chemical) or ASME B31.9 (Building Mechanical). The more stringent requirement between the standards and this specification shall be met.
- For ductwork testing requirement refer to Section 15800.
- Provide additional temporary restraints where required due to pipe joints, expansion joints, etc.
- All testing to be witnessed. Pretest systems prior to witnessed test. Record all testing on a from similar to that attached as Appendix ‘A’, Section 15030.
- All lines to be flushed prior to testing. Final cleaning, disinfection and/or chemical cleaning to follow testing.

Specific

(1) Test in accordance with CSA B149.1.
(2) Working pressures identified in the table are approximated. Test with refrigerant and/or nitrogen.

LEGEND: (H) Hydraulic (P) Pneumatic (O) Other

END OF SECTION

TESTING 15030A

LOCATION _____ DATE _____
Service: _____ Line Number: _____
Approximate Total Pipe Length: _____

CLEANING
Date: _____ Time: _____ Specification: _____

CIRCULATION PUMP
Flow Rate: _____ Duration: _____ Branch Circulation: ☐ yes ☐ no

WITNESS
Contractor's Name: _____ Signature: _____
Owner Rep. Name: _____ Signature: _____

FLUSHING
Date: _____ Time: _____ Specification: _____
Medium: _____
Flow Rate: _____ Duration: _____

WITNESS:
Contractor's Name: _____ Signature: _____
Owner Rep. Name: _____ Signature: _____

TESTING:
Date: _____ Time: _____

Types of Joints: _____
Types of Test: ☐ Hydrostatic ☐ Pneumatic
Final Test Pressure: _____ Duration: _____
Calibrated Gauge: ☐ yes ☐ no Gauge Range: _____
Test: Medium Temperature Begin: _____ End: _____
Ambient Temperature Begin: _____ End: _____
Visual Inspection: ☐ yes ☐ no

WITNESS
Contractor's Name: _____ Signature: _____
Owner Rep. Name: _____ Signature: _____

PIPING SYSTEM COMMISSIONING (Section 15030)

Notes:
1. Complete all sections of the form.
2. Attach schematic sketch of system or section of piping being tested.
3. Attach copy of laboratory report for disinfection testing where applicable.

PROJECT

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 Balance the following systems and coordinate with Commissioning Activities:
  .1 Hydronic Heating System and related building systems.
  .2 Ventilating including Air Conditioning and Ventilation, Make-up and Exhaust System(s).

.2 Perform individual equipment tests to verify unit capacity and general performance.

.3 Coordinate with work in other sections to ensure that all field installed devices, primary elements, test wells and holes are provided.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
  .1 American Society of Heating, Refrigerating and Air-Conditioning Engineer (ASHRAE):
    .1 ASHRAE Standard 111 - Measurement, Testing, Adjusting, and Balancing of Building, Heating, HVAC Systems.
  .2 Associated Air Balance Council (AABC)
  .3 National Environmental Balancing Bureau(NEBB)
  .4 National Building Comfort Testing Association(NBCTA)
  .5 Ontario Building Code.
  .6 Ontario Electrical Safety Code.

1.3 SUBMITTALS

.1 Prior to fabrication of piping and ductwork, submit preliminary plan indicating locations for primary elements, tappings, etc., necessary to complete the balancing.

.2 Submit certified reports for review listing system and equipment data to Part 3 requirements.

.3 Final reports to generally be in accordance with the AABC published National Standards for total system balance, current edition.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Close Out requirements

1.5 MAINTENANCE AND SPARE PARTS

.1 N/A

1.6 QUALITY ASSURANCE

.1 Carry out balancing in accordance with ANSI, ASHRAE Standard 111, Measurement, Testing, Adjusting, and Balancing of Building, Heating, HVAC Systems.

1.7 COMMISSIONING

.1 N/A

1.8 TRAINING

.1 N/A

1.9 WARRANTY

.1 Provide joint guarantee for one year from AABC., N.E.B.B. or N.B.C.T.A. and Testing Company stipulating quality of work performed in accordance with Codes and Standards.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Provide calibrated measurement equipment to measure air and water flows.

.2 Provide non-intrusive flow meter to measure liquid flows.

.3 All test equipment to be independently calibrated by a firm normally providing this service.

.4 Include calibration reports and equipment specifications in final balancing report.

PART 3 - EXECUTION

3.1 GENERAL REPORTING REQUIREMENTS

.1 Review specifications and drawings, make site visits, prepare reports and ensure all systems operate to specified requirements.

.2 Conduct site inspection during course of construction and make recommendations to ensure proper provisions are made for testing and balancing.

.3 Carry out startup balancing after startup/operation reports are completed. Submit startup report of equipment and system performance including actions required to conform with contract documents.

.4 Carry out final balancing after final verification of controls is completed. Submit final balancing report of system and controls performance including actions required to conform to contract documents. Identify and schedule seasonal balancing work required.

.5 Carry out seasonal balancing and report on system performance as required. Verify heating system performance at or near winter design conditions.

3.2 BALANCING

.1 Balance all air outlets and water flow terminals to -5% to +10% of design flows.

.2 Total energy balance to be within +10% of design.

.3 Adjust fan speeds and modify pumps or controls as required to produce design flow.

.4 Allow all costs to change sheaves on at least four (4) pieces of belt driven equipment. Owner will supply sheaves and belts as advised by balancing Contractor.

.5 Adjust system for design outside air quantity.

.6 Adjust system for design exhaust air quantity.

.7 Multi speed supply and exhaust systems driven by variable speed drives require that balancing contractor work with VSD supplier to establish and fix set VSD speeds.

.8 Test and record heating and cooling apparatus entering and leaving air, water, and refrigerant temperatures.

.9 In consultation with the Owner, following complete finishing of the spaces, adjust flow patterns from air distribution devices to minimize drafts.

.10 Verify that all controls are functioning as intended.

.11 Document verification process.

3.3 PERFORMANCE TESTS, GENERAL

.1 Conduct capacity tests on all HVAC equipment. Tests to be made during a period of stable operation and minimum load fluctuation. Submit performance report for each item tested which includes a comparison of installed capacity and design capacity.

.2 Provide manufacturers data, design data and recorded data in test reports.

.3 Provide nameplate data, tested electrical data and heater size and rates for all motors.

.4 Provide schematics for each test report identifying all components with system and position of controlling devices.

.5 Carry out final balancing under peak load conditions to suit system and outdoor conditions. Where loads cannot be simulated final tests to be carried out at time of peak condition.

.6 Verify variable volume systems/equipment performance under minimum and maximum conditions. Final tests to be carried out with controls operating.

.7 Measure differential pressure between the following areas and balance to have the second listed area at a positive pressure with respect to other spaces.

Table: Space Differential Pressure Verification		
Low Pressure Space	**Positive Pressure Space**	**Minimum Pressure Differential**
Pump Room	Electrical Room	25 Pa
Outside	Electrical Room	25 Pa (when electrical room fan operating)
Pump Room	Outside	25 Pa

3.4 DUCT SYSTEM BALANCING

.1 Duct System Balancing report to include:
- .1 Duct Air Quantities:
  - .1 Mains, Branches, Fresh Air and Exhaust Identification.
  - .2 Duct Sizes.
  - .3 Number of Pressure Readings.
  - .4 Sum of Velocity Measurements.
  - .5 Average Velocity.
  - .6 Duct Recorded L/s.
  - .7 Duct Design L/s.
- .2 Air Inlets and Outlets:
  - .1 Supply or Exhaust Outlet Identification (Location and number designation).
  - .2 Manufacturers Catalogue Identification and type.
- .3 Application Factors re: Velocity, Area, etc. and designated area.
- .4 Design and Recorded Velocities - m/s.
- .5 Design and Recorded Quantities - L/s.
- .6 Deflector Vane or Diffusion Cone Settings.

3.5 FANS, AIR HANDLING EQUIPMENT

.1 Air Handling Equipment report to include:
- .1 Equipment:
  - .1 Manufacturer and model.
  - .2 Size.
  - .3 Arrangement discharge and class.
  - .4 Motor type, kW, volt, phase, cycles and F.L.A.
- .2 Design Data:
  - .1 L/s.
  - .2 Static pressure.
  - .3 Motor kW, rpm and amps.
  - .4 Fan rpm.
  - .5 Motor amperage rating, volts, phase.
  - .6 Motor kW.
- .3 Fan Recorded Data:
  - .1 L/s.
  - .2 Static pressure (suction, discharge, total).
  - .3 Fan rpm.

.4 Motor operating amps, volts, phase.
.5 Motor operating kW.
.6 Pulley sizes.
.7 Belt size and quantity.

.2 Include pressure drop data for all accessories and equipment in system.

.3 Verify and report on performance minimum and maximum volume condition under variable volume control and at minimum and maximum outside air condition under economizer control.

3.6 HYDRONIC SYSTEMS

.1 Conduct tests to balance each water and glycol system. Adjust circuit setter balancing valves to ensure water circulates at specified quantity and equipment performs as required.

.2 Air Heating Equipment report to include:
.1 kW (and method of determining).
.2 L/s fluid (from flow measuring device and energy balance).
.3 Entering and leaving water temperature.
.4 Entering and leaving air temperature (dry bulb and wet bulb).
.5 L/s air.
.6 Water pressure drop.
.7 L/s from manufacturers curves.
.8 Coil or element type and identification (location and number designation).
.9 Adjusted temperature rise or drop.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 Section includes gauges and thermometers for all process and building mechanical applications alike.

.2 Refer to Process Controls and Instrumentation sections as well as project detail drawings, PFD, P&ID and MID drawings to determine extent of in-line instruments. Install in accordance with manufacturer's and supplying contractor's written instructions.

.3 Refer also to Table of Devices in Division 17 for list of instruments.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.

- .1 American Society of Mechanical Engineers (ASME):
  - .1 ASME B40.100-2013 – Pressure Gauges and Gauge Attachments
- .2 Ontario Building Code.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010 for all part PART 2 – PRODUCTS including accessories.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 Contractor shall verify and demonstrate that proper access and maintenance can be performed on the thermometers/gauges installed.

.2 Provide Spare Parts in accordance with procedures outlined in Division 1.

.3 Provide one (1) spare gauge for each pressure range.

.4 Provide two (2) spare diaphragm seal assemblies, including gauges for every 10 gauges provided.

1.6 QUALITY ASSURANCE

.1 Pressure gauges to be of the same make and style throughout. Conform to ASME B40.100-2013.

.2 In cooperation with Process Controls and Instrumentation Supply Contractor, submit sketches of instrumentation installation, locations and requirements as part of the shop drawing review process.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

.1 Gauge: Liquid filled gauge minimum 100 mm face, solid front, blowout back, stainless steel case, full gasket bayonet lock ring. Bourdon tube: phosphor bronze, soldered to 6 mm brass socket. Movement: stainless steel and mounted independent of case. All wetted parts to be stainless steel or monel.

.2 Adjustment: equip gauge with dial face zero reset screw.

.3 Accuracy: 1% over full scale range, ASME B40.100 Grade 1A.

.4 Indication: select range for mid-point indication during normal operating conditions.

.5 Scale graduations: kPa. Figures to be black embossed on white surface.

.6 Specified Product: Trerice 750 Series (liquid filled).

.7 Acceptable Alternates for Gauges and Accessories:
- .1 Ashcroft.
- .2 Winters.
- .3 Wika.

2.2 GAUGE ACCESSORIES

.1 Snubbers
- .1 Gauges installed on water piping to be equipped with 6 mm 316 stainless steel snubber.
- .2 Specified Manufacturer:
  - .1 Trerice D370 (water).

.2 Gauge Cock
- .1 Ball valve; 316 stainless steel body and seat, Teflon packing, chrome plated brass handle.
  Maximum operating pressure: 20,670 kPa
  Maximum operating temperature: 204°C
- .2 Specified Manufacturer: Trerice 735-8 Type FFG.

.3 Diaphragm Seals

.1 Provide Standard diaphragm seal as listed to include:

- filling screw connection to be leaktight
- type 316L stainless steel construction
- flushing connection with shutoff valve; clean-out design
- stainless steel diaphragm capsule
- Viton diaphragm
- glycerin filled.

.4 Diaphragm seals to be factory mounted to gauges.

.5 Provide diaphragm seals for the following services:

- all Raw Sewage lines
- Chemicals.

.6 Specified Product: Trerice 516.

.7 Alternate Manufacturers:

.1 Ashcroft
.2 Winters
.3 Wika.

2.3 ROOM DIFFERENTIAL PRESSURE GAUGES

.1 Gauge: Visual differential pressure indicator for positive room application. 100 mm diameter unit complete with magnetic backed room application labels and adhesive indicator operation label.

.2 Specified Product: Airflow Direction Inc., Model ADI-69-V-P.

.3 Alternate Manufacturers:

.1 Approved Alternate

PART 3 - EXECUTION

3.1 PRESSURE GAUGE INSTALLATION

.1 Provide gauges as indicated on the Drawings and in the following Table.

.2 Gauges are indicated on Drawings and details by ISA “PI” symbol. Provide tappings as indicated in Table and on Drawings.

Table: Pressure Gauges

Equipment	Note	Range	Units	Equipment Inlet	Equipment Outlet	Diaphragm Seal
Pump	Raw Sewage	0 to 410	kPa		See Detail/PID	Yes
Pump	Raw Sewage	-100 to 100	kPa	See Detail/ PID		Yes

.3 A tapping is to include a connection to the main, a valve and fittings per drawing details. Install a plug where gauge is not installed. Gauge is not required.

.4 Diaphragm seals and gauges to be factory assembled.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 Unless specified otherwise, this section defines the requirements of all motors and drives associated with motor drive equipment noted in Division 11 and Division 15.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of the project tender date.

- .1 Canadian Standards Association (CSA):
  - .1 CSA C22.2 No. 100 - Motors and Generators.
  - .2 CSA C22.2 No. 145 – Motor and Generators for Use in Hazardous Locations.
  - .3 CSA C390 – Energy Efficiency Test Methods for Three Phase Induction Motors.
  - .4 CSA Z-432 – Safeguarding of Machinery.
- .2 American Bearing Manufacturers Association (ABMA):
  - .1 ABMA 9, Load Ratings and Fatigue Life for Ball Bearings.
  - .2 ABMA 11, Load Ratings and Fatigue Life for Roller Bearings.
- .3 Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - .1 IEEE 85, Test Procedure for Airborne Sound Measurements on Rotating Electric Machinery.
  - .2 IEEE 112, Standard Test Procedures for Polyphase induction Motors and Generators.
  - .3 IEEE 114, Standard Test Procedures for Single-Phase Induction Motors.
  - .4 IEEE 620, Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Motors.
  - .5 IEEE 841, Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors.
- .4 National Electrical Manufacturers Association (NEMA):
  - .1 NEMA MG1, Motors and Generators.
  - .2 NEMA MG13, Frame Assignments for Alternating Current Integral Horsepower Induction Motors.
  - .3 NEMA 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
  - .4 NEMA MG 1Part 31, Definite-Purpose Inverter Fed Polyphase Motors.
- .5 Electrical Equipment Manufacturers Association of Canada (EEMAC):
  - .1 Standard MG2, Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators.
- .6 National Fire Protection Association (NFPA):
  - .1 NFPA 70, National Electrical Code (NEC).
- .7 Underwriters Laboratories (UL):
  - .1 UL1, Flexible Metal Conduit.
  - .2 UL 674, Standard for Safety Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.
  - .3 UL 2111, Overheating Protection for Motors.

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1, and Division 15, Section 15010. All submittals to be

submitted under cover of associated Division 11 or Division 15 equipment.

.2 In addition to the submittal requirements identified in the above-noted sections, submit the following for all PART 2 – PRODUCTS.

.1 Product Data:

.1 Nameplate data in accordance with NEMA MG 1.

.2 Rating Information:

.1 Service factor.

.2 Locked rotor current.

.3 No load current.

.4 Adjustable frequency drive motor load classification (e.g., variable torque); maximum torque and allowable motor speed range.

.5 Guaranteed minimum full load efficiency and power factor.

.6 Insulation rated thermal class.

.7 Operational thermal rise classification at nameplate load at 40 Deg. C ambient.

.8 Motor NEMA Design Type.

.3 Enclosure type and mounting (e.g., horizontal, vertical).

.4 Conduit box dimensions and usable volume as defined in NEMA MG 1.

.5 Bearing type.

.6 Bearing lubrication.

.7 Bearing life.

.8 Space heater voltage and watts.

.9 Description, ratings and wiring diagram of motor thermal protection. Motor sound power level in accordance with NEMA MG 1.

.10 Maximum brake horsepower required by the equipment driven by the motor.

.11 Stamped drawings by a licensed professional engineer in the Province of Ontario of equipment guards indicating compliance with OHSA and CSA requirements and applicable safety standards.

.2 Operation and Maintenance Data:

.1 Operation and Maintenance Manuals – to be in accordance with Division 1 requirements.

.2 Installation requirements and/or recommendations.

.3 Certificate of proper installation.

.3 Quality Control Data:

.1 NEMA M61, Part 31 – Certification for Inverter Duty Motors.

.2 Factory Test Reports.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed equipment.

.2 Provide spare parts in accordance with procedures listed in Division 1.

.3 Refer also to individual specification sections of Division 11 and Division 15 for additional motor requirements.

1.6 QUALITY ASSURANCE

.1 The motor manufacturer or its factory trained representative shall provide a written certification on OEM letterhead stating that the motor has been installed to their standards.

.2 When referenced by a motor-driven equipment specification outside of this section, any deviations or discrepancies shall be clearly identified as a deviation from this Section within shop drawing submissions.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 Use manuals to review routine maintenance and teardown. Provide photographs in manual illustrating each step of a typical teardown.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

.2 Individual specification sections within Division 11 and Division 15 may have additional warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL

.1 For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.

.2 In order to obtain single source responsibility, utilize a single supplier to provide a drive motor, its driven equipment, and specified motor accessories.

.3 Meet requirements of NEMA MG 1.

.4 Frame assignments in accordance with NEMA MG 13.

.5 Provide motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

.6 Motors shall be specifically designed for the use and conditions intended, with a NEMA B Design Letter Classification to fit the application.

.7 Lifting lugs on all motors weighing 45 kg or more.

.8 Operating Conditions:

.1 Maximum ambient temperature not greater than 40 degrees C.
.2 Class B (80 Degrees C) Rise in winding temperature when operating at rated nameplate conditions.
.3 General Purpose and Inverter Duty Motors shall be suitable for the intended operating conditions without any reduction being required in the nameplate rated horsepower, operational speed range, or exceeding the rated temperature rise of the machine.
.4 Overspeed in either direction in accordance with NEMA MG 1.

.9 TEFC: Totally enclosed, fan-cooled enclosure.

.10 Motor Nameplate Horsepower: The rating after any derating required to allow for extra heating caused by the harmonic content in the voltage applied to the motor by its controller.

.11 Inverter Duty Motor: Motor meeting all applicable requirements of NEMA MG 1, Section IV, Parts 30 and 31.

2.2 HORSEPOWER RATING

.1 As designated in motor-driven equipment specifications or drawings.

.2 Constant Speed Applications: Brake horsepower of the driven equipment at any operating condition not to exceed motor nameplate horsepower rating, excluding any service factor.

.3 Adjustable Frequency and Adjustable Speed Applications (Inverter Duty Motor): Driven equipment brake horsepower at any operating condition not to exceed motor nameplate horsepower rating, excluding any service factor.

2.3 SERVICE FACTOR

.1 At least 1.15 SF at maximum rated ambient temperature for General Purpose motors.

.2 A 1.00 SF at maximum rated ambient temperature for only Inverter Duty Rated motors.

2.4 MOTOR POLES

.1 Unless indicated otherwise in separate motor-driven equipment specifications or drawings, squirrel cage induction motors shall be typically of 4 Pole Design.

.2 A 1.00 SF at maximum rated ambient temperature for only Inverter Duty Rated motors.

2.5 VOLTAGE AND FREQUENCY RATING

.1 System Frequency: 60 Hz.

.2 Voltage Rating: Unless indicated otherwise in separate motor-driven equipment specifications or drawings, three phase motors shall be typically be 575 VAC, 3 Phase machines.

.3 Suitable for full voltage starting.

.4 Suitable for accelerating the connected load with supply voltage at motor starter supply terminals dipping to 80 percent of motor rated voltage.

2.6 EFFICIENCY POWER FACTOR

.1 For all motors except single-phase, under 1 horsepower, multispeed, short-time rated and submersible motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists:

.2 Efficiency:
- .1 Only NEMA Premium® efficiency motors are acceptable as per NEMA MG 1 Tables 12-12 and 12-13.
- .2 Tested in accordance with CSA C390, paragraph 12.59.
- .3 Guaranteed minimum at full load in accordance with NEMA MG 1 Table 12-10, or as indicated in motor-driven equipment specifications.

.3 Power Factor: Guaranteed minimum at full load in accordance with Section 15053.1 “Electric Equipment Motors and Drives - Table 1”, or as indicated in motor-driven equipment specifications or drawings.

2.7 LOCKED ROTOR RATINGS

.1 Locked Rotor kVA Code G or lower, if motor horsepower not covered by NEMA MG 1 tables.

.2 Safe stall time 12 seconds or greater

2.8 INSULATION SYSTEMS

.1 Motors Rated: Sealed windings in accordance with NEMA MG 1 and IEEE 841.

.2 Inverter Duty motors to have NEMA MG1 Part 31 Certified insulation systems.

.3 Unless otherwise indicated in motor-driven equipment specifications, Class F Winding Insulation shall be provided.

2.9 ENCLOSURES

.1 Enclosures to conform to NEMA MG 1.

.2 Unless noted otherwise in motor driven equipment specifications or drawings, TEFC motor enclosures shall be typically provided. Furnish TEFC motors with a drain hole with porous drain/weather plug.

2.10 EQUIPMENT GUARDS

.1 Provide protective galvanized metal guards of solid metal over all revolving parts of couplings and shafts, in accordance with the requirements of the Ministry of Labour, and to the approval of the Engineer. The guards shall be firmly held in place, and easily removable. Openings shall be provided

as necessary to permit lubrication of grease nipples or oil cups, insertion of test instruments without removal of the guards.

.2 Provide guards to totally enclose all exposed belt driven assemblies and rotating components in general conformance with CSA Z-432 or OSHA Standard guidelines. Provide:
- .1 Expanded metal screen welded to 25 mm steel angle frame.
- .2 1.2 mm thick (No. 18 USSG) galvanized sheet metal tops and bottoms.
- .3 Removable side(s) for servicing.
- .4 28 mm diameter branded hole on shaft center to insert tachometer.
- .5 Allowance for motor movement during belt tension adjustment.

2.11 TERMINAL (CONDUIT) BOXES

.1 Oversize main terminal boxes for all motors.

.2 Diagonally split, rotatable to each of four 90 degree positions. Threaded hubs for conduit attachment. Furnish gaskets between box halves and between box and motor frame.

.3 Minimum usable volume in percentage of that specified in NEMA MG 1, Section 1, Paragraph 4.19 and NFPA 70, Article 430:

Terminal Box Usable Values		
Voltage	**Horsepower**	**Percentage**
600 and below	15 through 125	500
600 and below	150 through 300	275

.4 Terminal for connection of equipment grounding wire in each terminal box.

2.12 BEARINGS AND LUBRICATION

.1 Horizontal Motors:
- .1 Through 400 Horsepower: Re-greasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
- .2 Minimum 100,000 hours L 10 bearing life for ball and roller bearings as defined in ABMA 9 and 11.

.2 Oil Lubrication Systems (where required for large motors):
- .1 Oil reservoirs with sight level gauge.
- .2 Oil fill and drain openings with opening plugs.
- .3 Provisions for necessary oil circulation and cooling.

.3 Bearing Isolation: Inverter Duty Motors shall have an electrically isolated bearing on non-drive end and common mode shaft grounding brush protecting the drive end bearing.

2.13 NOISE

.1 Measured in accordance with IEEE 85 and NEMA MG 1.

.2 Motors controlled by adjustable frequency drive systems shall not exceed sound levels of 3 dBA higher than NEMA MG 1.

2.14 BALANCE AND VIBRATION CONTROLS

.1 In accordance with NEMA MG 1, Part 7.

2.15 EQUIPMENT FINISH

.1 Internal Finish: Bore and end turns coated with clear polyester or epoxy varnish.

2.16 SPECIAL FEATURES AND ACCESSORIES

.1 Winding Thermal Protection:
- .1 Resistance Temperature Detectors:
  - .1 To be provided with motors 37 kW (50 horsepower) and larger.
  - .2 100 ohm precision resistors with calibrated resistance-temperature characteristics.
  - .3 Six (two for each phase) positioned to detect highest winding temperature and located between coil sides in stator slots.
  - .4 Compatible with monitoring instrumentation.
  - .5 Leads brought to separate motor terminal box.
  - .6 Provide separate stainless steel RTD connection nameplate.

.2 Vibration detection sensors as required in other motor driven specification requirements.

.3 Nameplates:
- .1 Raised or stamped letters on stainless steel or aluminum.
- .2 Display motor data required by NEMA MG 1, paragraphs 10.39 and 10.40 in addition to bearing numbers for both bearings.
- .3 Premium efficiency motor nameplates to also display NEMA nominal efficiency, guaranteed minimum efficiency, full load power factor, and maximum allowable kVAR for power factor correction capacitors.

.4 Anchor Bolts: Provide anchor bolts meeting manufacturer’s recommendations and of sufficient size and number for the specified seismic conditions.

2.17 SPECIAL MOTORS

.1 Requirements in this article take precedence over conflicting features specified elsewhere in this Section.

.2 Inverter Duty Motor:
- .1 Motor supplied power by adjustable voltage and adjustable frequency drives shall be Inverter Duty Rated.
- .2 Motor shall be suitable for operation over entire speed range indicated without reduction in available torque or exceeding maximum rise in operating temperatures.
- .3 Provide forced ventilation where speed ratio is greater than published range for motor being installed.

.4 Motor shall be capable of 10:1 VFD turn down ratio.

2.18 V-BELT DRIVE ASSEMBLIES

.1 Fit reinforced belts in sheave grooves matched to drive. Multiple belts on unit to be matched set.

.2 Use cast iron sheaves. Secure to shaft with removable key.

.3 Use sheave with split tapered bushing and keyway with fixed pitch for motors unless specific exceptions required for item concerned.

.4 Use minimum drive rating of 1.5 times motor nameplate rating, including service factor. Keep overhung loads within manufacturer's design requirements on all prime mover shafts.

.5 Allow for 150 mm minimum center line adjustment for belt drive units with motor slide rail adjustment plates.

.6 Select drives and belts for blowers and pumps for intermittent start/stop duty at hourly intervals.

2.19 FACTORY TESTING

.1 Manufacturer's Tests:
- .1 In accordance with CSA C390 for polyphase motors and for single-phase motors.
- .2 Routine (production) tests on all motors in accordance with NEMA MG 1, plus no load power at rated voltage and polyphase, rated voltage measurement of locked rotor current. Test multispeed motors at all speeds.
- .3 For energy efficient motors, test efficiency at 50, 75, and 100 percent of rated horsepower:
  - .1 In accordance with CSA C390 or IEEE 112, Test Method B, and NEMA MG 1, paragraphs 12.59, and 12.60.
  - .2 For motors 500 horsepower and larger where facilities are not available to test by dynamometer (Test Method B), determine efficiency by CSA C390 or IEEE 112, Test Method F.
- .4 Power Factor:
  - .1 Speed.
  - .2 Current at rated horsepower.
  - .3 kW input at rated horsepower.
  - .4 On motors of 75 kW (100 horsepower) and smaller, furnish a certified copy of a motor efficiency test report on an identical motor.
- .5 Temperature rise at rated kW (horsepower) for motors.

.2 Test Report Forms:
- .1 Efficiency and power factor by CSA C390.
- .2 Temperature Test: CSA C390 or IEEE 112, Form A-2.

2.20 SITE TESTING

.1 Contractor to perform the following motor electrical tests after installation but before startup and commissioning activities of the motor driven equipment:

.1 For all applicable Inverter Duty process motors as per Section 16031 “Inspection and Testing”.

2.21 SPECIFIED MANUFACTURERES

.1 GE Canada.

.2 Leeson Canada.

.3 Reliance Electric.

.4 MagneTek.

.5 Baldor.

.6 U.S. Electrical Motors.

.7 TECO Westinghouse Motor Co.

.8 Toshiba International Corp., Industrial Division.

.9 WEG Electric Motors Corp.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 In accordance with manufacturer’s instructions and recommendations.

.2 Align motor carefully and properly with driven equipment.

.3 Secure equipment to mounting surface with anchor bolts.

3.2 SUPPLEMENTS

.1 Motor Performance Requirement Table included at the end of this section.

END OF SECTION

TABLE 1
MOTOR PERFORMANCE REQUIREMENTS

		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom. Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
1	1,800	82.5	82.5			Mfr.'s Std.	Mfr.'s Std.		
	1,200	80.0	80.0			Mfr.'s Std.	Mfr.'s Std.		
1.5	3,600	82.5	82.5			Mfr.'s Std.	Mfr.'s Std.		
	1,800	84.0	84.0			Mfr.'s Std.	Mfr.'s Std.		
	1,200	84.0	85.5		82.0	Mfr.'s Std.	Mfr.'s Std.		Mfr.'s Std.
2	3,600	84.0	84.0			Mfr.'s Std.	Mfr.'s Std.		
	1,800	84.0	84.0			Mfr.'s Std.	Mfr.'s Std.		
	1,200	85.5	86.5	83.7	83.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	82.9	82.5	82.9	81.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
3	3,600	84.0	85.5	82.0	82.0	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,800	86.5	87.5	84.8	84.8	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,200	86.5	87.5	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	84.1	83.0	84.1	82.9	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
5	3,600	85.5	87.5	84.8	84.8	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,800	87.5	87.5	84.8	84.8	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,200	87.5	87.5	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	87.5	85.5	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
7.5	3,600	87.5	88.5	84.8	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.

TABLE 1
MOTOR PERFORMANCE REQUIREMENTS

		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom. Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
	1,800	88.5	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
7.5	1,200	88.5	89.5	88.4	87.5	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	87.5	85.5	87.5	86.6	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
10	3,600	88.5	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,800	89.5	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,200	90.2	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	89.3	88.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
15	3,600	89.5	90.2	88.4	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,800	91.0	91.0	90.9	90.2	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,200	90.2	90.2	90.2	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	89.3	88.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
20	3,600	90.2	90.2	90.9	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,800	91.0	91.0	91.7	90.9	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,200	91.0	90.2	90.2	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	90.2	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
25	3,600	91.0	91.0	91.7	90.2	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,800	91.7	92.4	92.4	91.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,200	91.7	91.7	90.9	89.3	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.

TABLE 1
MOTOR PERFORMANCE REQUIREMENTS

		% Guar. Min. Full Load Efficiency				% Guar. Min. Full Load Power Factor			
		Horizontal		Vertical		Horizontal		Vertical	
hp	Nom. Speed rpm	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC	Drip-proof ODP	TEFC
	900	90.2	89.5	89.3	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
30	3,600	91.0	91.0	89.5	88.4	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,800	92.4	92.4	92.4	91.7	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	1,200	92.4	91.7	91.7	90.2	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
	900	91.7	91.0	90.9	90.9	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.	Mfr.'s Std.
40	3,600	91.7	91.7	90.2	89.3	86.6	86.1	87.0	89.0
	1,800	93.0	93.0	92.8	91.7	78.2	78.2	83.0	84.5
	1,200	93.0	93.0	91.7	90.9	81.5	81.5	81.5	81.5
	900	91.7	91.0	90.9	90.2	70.0	70.5	70.0	70.5
50	3,600	92.4	92.4	90.2	89.3	85.1	86.7	89.0	89.0
	1,800	93.0	93.0	92.8	91.7	79.5	79.4	82.5	82.5
	1,200	93.0	93.0	91.7	90.9	81.5	81.5	81.5	81.5
	900	91.7	91.7	90.9	90.9	78.5	72.9	78.5	80.0
60	3,600	93.0	93.0	91.7	90.9	85.8	88.3	87.5	89.0
	1,800	93.6	93.6	93.5	92.8	80.5	79.9	80.5	80.5
	1,200	93.6	93.6	92.8	91.7	81.5	81.5	81.5	81.5
	900	92.4	91.7	91.7	90.9	79.5	73.2	79.5	79.5

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY:

.1 Includes, but is not limited tom, the support of Division 11 and Division 15 equipment.

.2 Unless detailed otherwise, this Division is to be responsible to provide all required equipment supports to the standards of Division 5.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
- .1 Canadian Standards Association (CSA):
  - .1 CSA W59-18: Welded Steel Construction.
  - .2 CSA G40.20-13: General Requirements for Rolled or Welded Structural Quality Steel
- .2 Ontario Building Code.

1.3 INFORMATIONAL SUBMITTALS

.1 Submit detail shop drawings of all supports for review by Consultant before fabrication or construction.

.2 Submit intended grout mix.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 N/A

1.6 QUALITY ASSURANCE

.1 Construct supporting structures to safely withstand operating stresses.

.2 Distribute load and impact over building areas. Refer to Section 15241 and coordinate with Contractor's Seismic Support Design Engineer for attachments to equipment and building structure.

.3 Conform to codes and regulations of agencies having jurisdiction.

.4 Weld steel standards to CSA W59-18.

1.7 COMMISSIONING

.1 N/A

1.8 TRAINING

.1 N/A

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Provide all special steel (angle iron, plate, pipe, etc.) supports required for support of tanks, pumps, motors, air handling units and other equipment supplied by this Section.

.2 Unless indicated otherwise, all supports to be hot dip galvanized.

.3 Material to CSA G40.20-13.

2.2 ANCHOR BOLTS

.1 Provide all anchor bolts not supplied by equipment manufacturers.

.2 Anchor bolts to be 304 stainless steel.

PART 3 - EXECUTION

3.1 EQUIPMENT FOUNDATIONS

.1 Co-operate with work of other trades in locating foundations and provide anchor bolts for concrete foundations, pedestals.

.2 Confirm all housekeeping pad dimensions prior to pouring of concrete.

.3 Confirm with manufacturer of equipment where foundation design is not indicated and provide foundation dimensions, size of foundation bolts, method of setting, aligning and anchoring of equipment.

.4 Allow minimum 25 mm grout space between machinery baseplate and concrete foundation, fill space complete. Do not remove leveling wedges before grout reaches final set. Fill voids left by removal of wedges with grout, finish exposed surface of grout to make neat appearance.

.5 Fill base plates with grout or concrete.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 Provide pipe sleeves for pipes passing through concrete walls or floors, unless detailed otherwise.
  .1 Provide waterproofing flanges for all pipe sleeves.
  .2 Provide smooth core through existing walls and floors as required and where detailed.
  .3 Seal all openings through sleeves.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
  .1 American Society of Mechanical Engineers (ASME):
    .1 ASME B31.3-20 – Process Piping.
  .2 Canadian Standards Association (CSA):
    .1 CSA W59-18: Welded Steel Construction.

1.3 INFORMATIONAL SUBMITTALS

.1 Submit shop drawings of modular sleeve seals.

.2 Submit Interference/Coordination drawings per Section 15010 prior to fabricating and installing sleeves. Submit sleeve drawing in conjunction with interference drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENT

.1 N/A

1.6 QUALITY ASSURANCE

.1 Sleeve construction and welding in accordance WITH CSA W59-18 and ASME B31.3

1.7 WARRANTY

.1 Refer to Division 1 and section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 For pipe diameter 750 mm and less, sleeves are to be constructed of carbon or stainless steel schedule pipe with a minimum Schedule 10 wall thickness.

.2 Pipe sleeves to be constructed with an annular fin (waterstop) continuously welded to the midpoint of the sleeve.

.3 Sleeves required as follows:

- .1 Through foundation walls and water retaining walls.
- .2 As detailed on drawings.
- .3 As required in Division 1

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Unless detailed otherwise terminate sleeves flush with vertical surfaces of concrete.

.2 Coordinate with Division 3 to core drill in existing floors, roofs and walls to accommodate mechanical work. Existing concrete reinforcing to be identified and marked by Contractor, for review by Consultant, prior to core drilling.

END OF SECTION

PART 1- GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This section describes the requirements associated with the erection of process and building services piping.

.2 Contractor is required to review the pipe supports for all sections of the following existing pipes within the pump station:

.1 All raw sewage pipes within the pump station, including but not limited to the pump room, and wet well.

.3 The Contractor is required to retain the services of a third-party pipe support designer to design the pipe supports in accordance with the requirements noted herein. In addition, the third-party designer is to review the pipe support installation and provide a sealed letter confirming that the support installation is in accordance with their design intent. Third party designer shall have shall have at least five years of experience in the analysis and design of similar systems.

.4 Contractor to coordinate with the Seismic requirements noted in Division 1 and in Division 15 Section 15241.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of the project tender date.

.1 American Society of Mechanical Engineers (ASME):

.1 ASME B31.1 – Power Piping.

.2 ASME B31.3 – Process Piping.

.3 ASME B31.9 – Building Services Piping.

.2 Manufacturers Standardization Society:

.1 MSS SP-58 – Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, application and installation.

.3 Ontario Building Code.

.4 National Plumbing Code.

.5 ASHRAE.

.6 Ontario Regulation 815.

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted sections, submit the following:

.1 For each piping system and method of support:

.1 General arrangement and coordination drawings for piping supporting elements and methods.

.2 Support elements: hangers, trapeze, restraints, anchors, guides and attachments. Submit load rating for each type of hanger, support and attachment to the building structure.

.3 Submittals to be stamped by a qualified Professional Engineer licensed in the Province of

Ontario and regularly designing piping support systems.
.4 Clearly identify design criteria, including, but not limited to:
.1 Seismic parameters
.2 Physical properties of fluids
.3 Pipe internal pressures
.4 All loads
.5 Using the contract drawings as a basis, mark-up to include piping supports location and type, generally in accordance with MSS SP-58.
.6 Submit copy of Cover Page and Table of Contents for each applicable MSS Standard (www.mss-hq.com).
.2 Provide a detailed resume, including references from projects within the past five years for the third-party pipe support engineer. Acceptance of the proposed support systems engineer shall be subject to the approval of Engineer.
.3 Submit manufacturer's recommended support spacing for plastic piping.
.4 Submit pipe support element inspection report in accordance with MSS SP-58, certified by a qualified Professional Engineer licensed in the Province of Ontario.
.5 Provide certification of the design and installation of the pipe support system by the Professional Engineer responsible for the design and stamping of submittal drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 N/A.

1.6 QUALITY ASSURANCE

.1 Manufacturing facilities shall be registered to ISO 9001.

.2 Conform to the latest edition of the following standards and codes in addition to these specifications.
.1 Pipe hangers and supports:
.1 Load ratings to ASME B31.1 or MSS SP-58.
.2 Fabrication and Installation Practices – MSS SP-58.
.3 Selection and Application – MSS SP-58.
.4 Materials, Design and Manufacture – MSS SP-58.
.2 Building Services Piping: ASME/ANSI B31.9.
.3 Process Piping: ASME/ANSI B31.3.
.4 Potable Hot and Cold Water: Ontario Building Code, National Plumbing Code.
.5 Sanitary and Storm Drainage Piping: Ontario Building Code, National Plumbing Code.
.6 Seismic Support: Ontario Building Code, ASHRAE.
.7 Unless stipulated otherwise all facilities to be considered a post-disaster facility. Refer to Division 1 and section 15241 for Seismic classification and associated requirements.

.3 Welding of:
.1 steel piping to be in accordance with specification 15061.
.2 fabricated supports and any welding to the building structure to be in accordance with

specification sections 05100 and 05500.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

1.8 TRAINING

.1 N/A.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

.2 Contractor to return to site eleven (11) months after Substantial Completion to verify and adjust hangers as required.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Specific support products are not included herein as it is the responsibility of the Contractor's Pipe Support Designer.

.2 The following support list is provided to identify the type of hangers and supports acceptable under this Contract. Provide the type of hangers and supports identified in this list where specific pipe support details are not called out on the Drawings.

.3 The "Type" listed refers to and is based on nomenclature from the MSS SP-58 standard.

.4 Type 19, Type 23, and similar type C-clamp supports are not permitted without restraint.

2.2 HANGERS AND SUPPORTS

.1 Process and HVAC Piping
- .1 U-Bolts:
  - .1 Type 24.
- .2 Clevis Hangers:
  - .1 Type 1.
  - .2 Type 39 or 40 protection shields for use on insulated pipe.
- .3 Yoke Type Pipe Clamp:
  - .1 Type 2. Use for pipe with up to 100mm (4 inch)insulation.
- .4 Pipe Clamps:
  - .1 Type 3, 4 and 12.
  - .2 Not for use on insulated pipes.

.5 Riser Clamps:
  .1 Type 8 and 42.
  .2 Not for use on insulated pipe.
.6 Straps:
  .1 Type 26.
.7 Pipe Rollers and Roller Supports:
  .1 Type 41 and 43.
  .2 Type 39 or 40 protection shields for use on insulated pipe.
.8 Trapezes:
  .1 Type 59.
  .2 Use Type 39 or 40 protective shields for insulated pipe. To be used only if all of the pipes to be supported are at the same bottom elevation.
.9 Roller Hanger:
  .1 Type 44
  .2 Type 39 or 40 protective shields for use on insulated pipe.
.10 Stanchions
  .1 Pipe Saddle:
    .1 Type 37.
    .2 Type 39 or 40 protective shields for use on insulated pipe.
  .2 Adjustable Pipe Saddle with U-bolt:
    .1 Type 38.
    .2 Type 39 or 40 protective shields for use on insulated pipe.
.11 Wall Brackets:
  .1 Custom fabricated wall brackets designed in consideration of loads and site specific requirements are permitted.
  .2 Light duty:
    .1 Type 31
  .3 Medium duty
    .1 Type 32.
  .4 Heavy duty
    .1 Type 33.
.12 Structural Attachments
  .1 Custom fabricated structural attachments designed in consideration of loads and site specific requirements are permitted. Note of welding to structure requires submission of loads and welding details and submitted for structural engineer of record approval.
  .2 Welded Beam Attachment:
    .1 Type 22.
  .3 Plate Lug:
    .1 Type 57.

.13 Strut Support Systems
  .1 System shall permit rigid metal construction without welding or drilling.
  .2 All members shall be fully adjustable, demountable and reusable.
  .3 One manufacturer shall furnish system complete with all nuts, bolts, couplers, channels and all other required fittings and mechanical accessories.
  .4 Channels and accessories shall be galvanized steel with 20 mil PVC coating, all of the same color.
  .5 All mounting hardware, fasteners and concrete inserts shall be Type 316 stainless steel.
  .6 Pipe clamps shall be PVC-coated galvanized straps with stainless steel rods, nuts, and flat washers.
  .7 Support Engineer to verify that the load carrying capacity of the strut system is adequate for weight of pipes and contents and span utilized.

.2 Acceptable support system manufacturers include:
- .1 Anvil International.
- .2 E. Myatt and Co. Inc.
- .3 Process Pipe Support Systems Inc.

.3 Acceptable strut support system manufacturers include:
- .1 Unistrut Corporation.
- .2 Eaton B-Line Systems.
- .3 Hilti Modular Support System

PART 3 - EXECUTION

3.1 GENERAL

.1 Install pipes parallel and close to the building structure.

.2 Locate groups of pipes parallel to each other and spaced at a distance to permit service access for valves or other equipment located above.

.3 Pipe routing, connections and take-offs to follow building lines.

.4 Provide swing joints, offsets and prefabricated expansion joints to accommodate pipe expansion or contraction due to temperature change and differential building movement. Coordinate piping and piping supporting elements with the building architecture, structure, electrical systems and other mechanical systems to ensure proper installation and access for maintenance and service.

.5 Coordinate pipe supporting elements with other systems, with provisions for vibration and seismic control.

.6 Provide all pipe supporting elements as necessary to ensure proper support under all operating conditions and in accordance with relevant standards and the constraints and requirements of the piping system manufacturer (pipe, fittings, valves, equipment, etc.).

.7 The drawings may provide some specific or specialty supporting details. Where applicable the pipe support designer shall integrate these into their design

.8 Do not conceal piping and pipe supporting elements before the completion of the Contractor’s quality assurance inspection and testing and approval of local authorities having jurisdiction.

3.2 PIPE SUPPORT

.1 The design of pipe supporting elements is dependent on Contractor controlled methods of installation and the physical characteristics, limitations and operating characteristics of the piping system.

.2 Methods of installation include the physical location of the pipe relative to the support structure, method of support (hanger, trapeze, etc.), attachment location (roof structure, column, interior wall, etc.), attachment method (cast-in-place, expansion inserts, structural bridging, clamping, etc.) and piping systems being supported (single, multiple, etc.).

.3 Provide pipe supporting elements to properly support piping system (pipe, fittings, valves, equipment, etc.) such that the piping system and pipe supporting elements are protected from excessive stress and distortion.

.4 Pipe supporting elements consist of: hangers, which support from above; supports, which bear load from below; restraints, anchors and guides which limit or direct movement, as well as support loads and attachments between support elements and the structure.

.5 Design the pipe supporting elements to carry the sum of all concurrently acting static and dynamic loads including the following:

.1 Dead weight of pipe, fittings, valves, insulation, inline equipment, hanger system, contents and other pipes (if supported from the line under consideration).

.2 Live weight of contents.

.3 Weight of test fluid, when greater than normal fluid (not considered concurrent with occasional loads).

.4 Occasional loads such as ice, wind and earthquake loads.

.5 Forces imposed by thermal expansion and contraction of pipe bends and loops.

.6 Forces imposed by differential movement of building structure.

.7 Frictional, spring, and pressure thrust forces imposed by expansion joints in the system.

.8 Frictional forces of guides and supports.

.9 Forces due to internal pressure including test pressures.

.10 Forces due to flow changes in direction at bends and elbows.

.11 Forces due to operation of safety, relief and stop valves.

.6 Each pipe support to be field adjustable under full load conditions.

.7 Readjust all pipe support elements after initial installation as required to suit final operating conditions.

.8 Prior to connecting pumping units or other equipment to pipe sections, support complete piping assembly and anchor in perfect alignment with pumping units and sleeves to prevent movement of piping assembly and strain on pumping units or equipment. Disconnect piping and demonstrate to Engineer that no strain is place on equipment connections.

.9 Support all valves and risers 75mm and above as well as those recommended by the support designer, so that weight of valve or valve assembly is not carried by adjacent horizontal pipe sections.

.10 Provide additional support and/or bracing to prevent equipment rotation in the pipe where components are connected to piping by grooved end couplings.

.11 Clean all surfaces to be encased by concrete to bare metal immediately before placing concrete.

.12 Ensure that position of pipe on supporting blocks is not disturbed when placing concrete.

.13 Concrete type supports to provide for not more than 120° contact area.

.14 Space pipe supports in accordance with manufacturer’s instructions or to prevent undue strain or sag.

.15 Pipe supports are to be OEM manufactured where commercially available. Provide custom-made supports where indicted or where directed by Consultant.

.16 Provide additional anchoring if pipe movements or vibrations are observed, resulting from fluid motions.

3.3 HANGERS

.1 Hangers to be capable of field adjustment while supporting the load.

.2 Turnbuckles and adjusting nuts are to have full thread engagement and suitable locking devices.

.3 Where piping moves horizontally due to thermal expansion/ contraction, hanger components to allow for swing and traveling devices (rolling or slip supports) and restraints are to be provided as required to limit hanger swing angle to less than 4°.

.4 Where piping moves vertically (thermal expansion) provide variable supports (spring cushion, variable spring and/or constant support hangers) as required to prevent the transfer of excessive loads to adjacent hangers, supports or connected equipment.

.5 Where the structure that pipe support element is attached to moves vertically (load changes, snow load on roof, etc.), provide variable supports (spring cushion, variable spring and/or constant support hangers) as required to prevent transfer of excessive loads to adjacent hangers, support or connected equipment.

.6 Provide variable supports with means to limit misalignment, buckling, eccentric loading and overstressing of the spring.

.7 Where trapeze supports are provided to reduce hanger attachments to the structure, individual hangers or base supports are to be provided for each pipe attached to the trapeze to allow for individual adjustment and support to suit requirements for sloping, horizontal movement and vertical movement.

3.4 MATERIALS

.1 Hangers for copper piping to be copper plated wrought steel.

.2 All supports, hangers, hanger rods, anchors, anchor guide braces, etc., located inside process tankage and channels or where submerged, to be fabricated of 316 stainless steel. Fasteners and associated hardware to be 316 stainless steel.

.3 Hot dip galvanize (ASTM A123) all supports, hangers, hanger rods, anchor guides, braces, etc., not specifically noted in Articles 3.4.1 and 3.4.2. Fasteners and associated hardware to be cadmium plated.

.4 Hot dip galvanize all supports, hangers, anchor guides, braces, etc., after fabrication and before installation. Electrogalvanized components will not be accepted.

.5 Except as noted in Articles 3.4.1 and 3.4.2 all bolts, washers, nuts, etc. cadmium plated or electrogalvanized.

3.5 SUPPORT SPACING

.1 Provide support spacing in accordance with MSS SP-58, ASME B31.1 and piping/fitting

manufacturer's standards.

.2 Use ASME B31.1 Standard for minimum rod diameter and spacing for pipe supports, with the following exceptions:
- .1 Minimum rod diameter: 12 mm.
- .2 Support plumbing piping in accordance with more stringent requirements of either Ontario Regulation 815 or as specified.
- .3 Support 12 mm nominal copper pipe every 1.5 m.
- .4 Support plastic piping in accordance with manufacturer's recommendations.

.3 Smallest pipe size to govern spacing between pipe rack supports.

.4 For ductile iron, cast iron, steel, copper and stainless steel pipe, do not exceed the following spans between hangers and supports on straight runs having no valves or fittings. Maximum support spacing not to exceed values indicated in table below.

PIPE SIZE	**MAXIMUM SPACING**	
(mm)	Sewage or Water Service	Air or Gas Service
Up to 25 mm*	1.8 m	2.1 m
30 mm to 50 mm	2.4 m	3.0 m
65 mm to 100 mm	3.0 m	4.2 m
150 mm to 200 mm	3.6 m	5.1 m
300 mm and larger	7.0 m	9.1 m
** For 12 mm copper pipe support spacing not to exceed 1.5 m.*		

.5 Support spacing to limit the stresses in the piping to less than the allowable stress when determined on the basis of a support span twice that of the actual span.

.6 Support spacing to limit the deflection to less than the smaller of 5 mm or 10% of the nominal diameter of the pipe, based on the weight of the empty pipe, insulation and other dead loads.

.7 Support spacing varies with pipe material (steel, cast iron, glass, plastic, etc.), type of fitting (screwed, welded, flanged, soldered. Brazed, thermoplastic welded, mechanical and proprietary joints, etc.), media contained (fluid, gas), ambient temperature and temperature of media contained.

3.6 ANCHORS, GUIDES AND RESTRAINTS

.1 Provide anchors, guides, pivots and other restraints required to secure piping (fittings, expansion joints, elbows, etc.) while withstanding thrusts, moments and other imposed loads.

.2 Where Z-bends, U-bends or pipe loop expansion arrangements are used, provide anchors and guides to direct movement along axis of joint. Guide spacing to take into consideration the column buckling strength of the pipe.

.3 Provide supplemental anchors, guides and restraints for joints that do not have a self-restraining design (mechanical and proprietary joints) in accordance with the manufacturer's requirements.

.4 Provide rolling or slip support or restraints necessary to ensure that the hanger attachment to the structure does not move out of a safe vertical position from pipe movement due to thermal expansion/contraction.

.5 Provide sway restraints or shock absorbing devices to ensure that the hanger attachment to the structure does not move out of safe vertical position due to shock loads (thrusts due to rapid flow or pressure changes).

3.7 PIPE ATTACHMENTS

.1 Provide non-integral type pipe attachments including clamps, slings, cradles, saddles, straps, clevises and rollers for support of horizontal piping.

.2 Non-integral pipe attachments (clamps) for vertical pipes are to incorporate shear lugs or be welded to the pipe to prevent slippage.

.3 Attachments for piping systems that require movement due to thermal expansion are to include rolling or sliding supports. The support is to include for free movement of the pipe or the imposed loads and friction forces of the supports

.4 Provide protective surfaces (pads, cushions, shields, etc.) on supports for piping that requires protection against contact damage in accordance with the pipe manufacturer's requirements.

.5 Pipe attachment material to be compatible with the pipe material or be suitably isolated to prevent contact of dissimilar metals to prevent corrosion.

.6 Pipe attachments for insulated pipe not to pierce insulation and to be provided with shields and/or insulated saddles to prevent insulation damage from the loads transmitted to the pipe support.

.7 Where welded integral type attachments are required (ears, shoes, lugs, cylindrical attachments, rings and skirts, etc.) for multi-axial type loading, materials to be compatible with piping and strength to be adequate for all expected loads.

.8 Coordinate with Division 9 to permit pipe to be continuously painted at hanger.

3.8 INSULATION SHIELDS

.1 Provide saddles for insulated piping being supported; saddles to fit tight to circumference of cladding. Exposed edges are not acceptable.
.2 Provide high density insulation blocks at each pipe saddle to avoid compressing pipe insulation at support

3.9 ATTACHMENT TO BUILDING STRUCTURE

.1 Spacing, location and loading of individual attachments and all piping system attachments not to exceed capacity of structure. Contractor's pipe support designer to review design load of structure with respect to load induced by pipe support systems.

.2 Attachments to concrete floor to be at least 400 mm from edge of slab.

.3 Attachments to concrete floor to be cast-in-place inserts or expansion studs and anchors. Explosive actuated fasteners not permitted.

.4 Attachments to composite metal roof deck not to interfere with composite behaviour of roof deck structure.

.5 Attachments to metal roof deck not permitted.

.6 Locate connections to open web steel joists at panel points.

.7 Attachments to steel structure to be bolted type connections.

.8 Attachments to open web steel joists to be at panel points.

.9 Beam attachments to provide concentric support on both sides of beam.

.10 Maximum loads on attachments to concrete not to exceed one-fifth of the ultimate strength of the attachment as determined by manufacturer’s tests. Install attachments in accordance with manufacturer’s requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This section covers the installation procedures, material specifications, worker qualifications and testing/inspection requirements for the welding of all steel piping.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of the project tender date.'

- .1 American National Standards Institute (ANSI):
  - .1 ANSI B16.9 – Factory-Made Wrought Steel Buttwelding Fittings.
  - .2 ANSI B16.11 – Forged Fittings, Socket Welding and Threaded.
  - .3 ANSI B16.25 Butt Welding Ends.
- .2 American Society of Mechanical Engineers (ASME):
  - .1 ASME Boiler and Pressure Vessel Code (BPVC), Section VIII, Rules for Construction of Pressure Vessels.
  - .2 ASME BPVC Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers and Welding and Brazing Operators.
  - .3 ASME BPVC Section V, Non-destructive Examination.
  - .4 ASME B31.3, Process Piping.
- .3 American Society of Non-destructive Testing (ASNT):
  - .1 SNT-TC-14 Personnel Qualification and Certification in Non-destructive Testing.
- .4 American Welding Society (AWS):
  - .1 AWS QC1 Standard for AWS Certification of Welding Inspectors.
- .5 Canadian Standards Association (CSA):
  - .1 CSA W178.1 Welding Inspection Organizations Company Certification.
  - .2 CSA W178.2 Welding Inspector Certification.

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 01 and Division 15.

.2 Quality Control Submittals:

- .1 Submit certified welding procedures to be used for specified welds. Procedures to be certified in accordance with ASME B31.3 and BPVC Section IX.
- .2 Provide manufacturer's record of certification for all materials to be used for welding.
- .3 Provide records of certification and qualifications for the following:
  - .1 Welders and Welding Operators.
  - .2 Weld Inspectors.
  - .3 Weld Inspection and Testing Agency.
- .4 Provide approved non-destructive inspection and testing procedures to be in accordance with ASME B31.3 and BPVC Section V.
- .5 Submit certified inspection and test reports to Consultant for review.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 Not applicable.

1.6 QUALITY ASSURANCE

.1 Welding installations to ASME B31.3.

.2 Welder to mark each weld with personal steel pencil for individual work identification. Mark each joint with stencil before radiographs are taken.

.3 Provide services of independent inspection and testing agency for welding operations.

.4 Welder and welding operator qualifications:
- .1 Welders to be qualified in accordance with ASME B31.3 and BPVC Section IX, Article III. Welder's certification of qualification not to be older than six (6) months and to be on file at work site.
- .2 Welders to be certified for position and materials required.
- .3 Welders to be certified for a minimum of twelve (12) months prior to work being completed on site.

.5 Inspection qualifications:
- .1 Welding inspector to be certified by one of the following governing bodies:
  - .1 AWS Certified, AWS QC 1 Qualified.
  - .2 CSA Certified to CSA W178.2.
- .2 Welding inspector to have prior inspection experience of specified welds.

.6 Independent inspection and Testing Agency qualifications:
- .1 Inspection and Testing Agency to be certified in accordance with:
  - .1 CSA W178.1.
  - .2 ASNT SNT-TC-14.
- .2 All testing and inspection personnel to be qualified and all equipment to be used is to be calibrated and in good working order.
- .3 Inspection and Testing Agency to have a minimum of the (10) years experience in the field of pipe welding.

1.7 COMMISSIONING

.1 Not applicable.

1.8 TRAINING

.1 Not applicable.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 PIPE FITTINGS

.1 Steel butt weld fittings: to ANSI B16.9.

.2 Steel socket weld fittings: to ANSI B16.11.

2.2

2.3 ELECTRODES

.1 Weld electrodes: in accordance with ASME B31.3 and BPVC Section II, Part C.

PART 3 - EXECUTION

3.1 WELDING REQUIREMENTS

.1 Provide welding by machine or manual shielded metallic arc process. Use direct current exclusively with base material on negative side of the line. Provide all position rod type electrodes suitable for the application.

.2 Details of welding technique and procedures, such as number of beads and passes, angle of surfaces to be welded, weld gap at base, electrode diameter, and average current values, are subject to review by Consultant or other representative.

.3 Equip welders working close to flammable materials with fire extinguishers. Observe necessary fire prevention precautions such as shields to avoid fire hazards.

.4 Welding to be performed in accordance with ASME B31.3.

3.2 PREPARATION FOR WELDING

.1 Use only piping with machine beveled ends to ANSI B16.25 for welded runs. If machining is impractical, prepare ends by grinding or flame cutting and by subsequent grinding back 3 mm prior to welding. Clean each joint internally and ensure ends are free from scale, surface cracks, oil, grease, oxides or other foreign matter before connecting to system. Ensure stainless steel wire brushes or stainless steel wool is used for cleaning of stainless steel joints.

.2 Fit backing rings accurately and weld to upstream interior of pipe. Remove weld slag and splatter prior to assembling pipe. Provide backing rings of suitable material for pipe, split or solid type.

.3 Align ends of pipe-to-pipe, pipe-to-fittings, expansion joint or valve, and fitting-to-valve joints as accurately as is practical within existing commercial tolerance on pipe diameters, wall thickness and out-of-roundness. Alignment to provide most favourable condition for deposition of root bead. Ensure

root gap is as per the qualified welding procedure. Preserve alignment during welding.

.4 After ends are properly spaced and aligned, hold in position by us of a temporary bar or clamp. Tack welds to be of same quality and same procedure as completed weld, performed by a qualified welder.

.5 Make welds full penetration, continuous and without defects, as per the qualified welding procedure. Clean each layer of weld to remove slag and scale, using appropriate materials for the joint. Chip where necessary to prepare for proper deposition of next layer.

3.3 WELDING INSPECTION

.1 Make work available at any time for inspection by Consultant. Cover or insulate welds only after inspection is carried out to the satisfaction of the Consultant and the Testing Agency.

.2 The extent and methodology of weld examination is to be as per ASME B31.3, which requires the following at a minimum:

- .1 Visual examination of sufficient materials and components, selected at random, to satisfy the examiner that they conform to specifications and are free from defects.
- .2 Visual examination of at least 5% of fabrication. For welds, each welder's and welding operator's work to be represented.
- .3 Not less than 5% of all welds to be fully examined by random radiographic testing or ultrasonic examination. Welds to be selected to ensure that work product of each welder or welding operator is included

.3 Visual inspection and non-destructive testing results to be interpreted in accordance with AWS and ASME B31.3. Weld acceptance criteria as per ASME B31.3. Any of the following could cause rejection of the weld:

- .1 Failure to meet radiographic requirements or other code tests;
- .2 Welding performed by unqualified personnel;
- .3 Welds not reasonably uniform in appearance;
- .4 Evidence of peening;
- .5 Cracks;
- .6 Oxidation around welds;
- .7 Lack of fusion;
- .8 Presence of porosity, slag, inclusion of overlaps;
- .9 Undercutting adjacent to completed welds or evidence of undercutting by grinding.

.4 Cut out and replace welds of poor or doubtful quality with satisfactory welds. Re-examination or testing will be at the Contractor's cost.

.5 Refer to Section 15030 for hydrostatic testing requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESRIPTION SUMMARY

.1 All new and/or modified piping systems to be cleaned and flushed in accordance with this section.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
  .1 Ontario Provincial Standard Specifications. (OPSS)
  .2 American Water Works Association (AWWA):
    .1 AWWA Standard C651 – Disinfection of Water Mains
    .2 AWWA Standard C652 – Disinfection of Water Storage Facilities
    .3 AWWA Standard C653 – Disinfection of Water Treatment Plants.
      .1 Ontario Building Code (OBC)
    .4 Chlorine Institute(CI):
      .1 Chlorine Institute: Pamphlet 6, Piping Systems for Dry Chlorine:

1.3 INFORMATION SUBMITTALS

.1 Submit all disinfection procedures.

.2 Submit documented results of disinfection and chemical cleaning.

.3 Record flushing and cleaning procedure and data in a form similar to that in Appendix “A”, Section 15030.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 Not Applicable

1.6 QUALITY ASSURANCE

.1 The disinfection of potable water systems to be in accordance with OPSS and AWWA guidelines.

PART 2 - PRODUCTS

2.1 FLUSHING WATER

.1 In addition to municipal water, separated water is available at the plant. Separated water is municipal water downstream of a backflow preventer. Although generally clean, there is some risk that it may be contaminated by a process connection for example.

2.2 GAS LINES

.1 Blow clean with air.

2.3 CHEMICAL LINES

.1 Flush with separated water. Blow dry with air and confirm system is dry prior to adding chemical.

PART 3 - EXECUTION

3.1 CLEANING AND FLUSHING OPERATION

.1 General:
- .1 Unless indicated otherwise, systematically clean and flush piping by isolating branches and forcing high velocity flow (greater than 2.0 m/s) through a limited number of branches at any one time.
- .2 Flushing of piping at high velocity may be replaced with pigging and then flushing at a velocity greater than 1.0 m/s.
- .3 For cleaning requirements, the Contractor is to assume that all pipes to be flushed and cleaned are full of debris, sediment and/or sludge/scum. It is the Contractor's responsibility to ensure that pipes and tanks are cleaned and that the solids flushed are disposed of appropriately.

.2 Process Lines:
- .1 Following successful testing, pass a foam pig through each line and then flush systems with effluent water at a rate of 2.0 m/s.
- .2 Pig and flush piping prior to connecting pumps and accessories.

END OF SECTION

16953-134 - CASSELMAN MAIN SPS UPGRADE

SECTION:15100

PROCESS VALVE SCHEDULE

JLR #: 16953-134

SHEET 1 OF 1

I.D.	DESCRIPTION	DATASHEET No.	OPERATION					ELECTRICAL			FIELD WORK				COMMENTS	ADD. No.
			OPERATOR	SIZE mm	LINE SIZE mm	FLUID	NORMAL POSITION	POWER HP	VOLTS V	PHASE	SUPP. BY	INST. BY	WIRED BY	COMM. BY		
AAV 10001	AIR RELEASE VALVE FOR EXISTING FORCEMAIN	G1	N/A	50	50		N/A	0	0	0	M	M	N/A	G		
AAV 11001	AIR RELEASE VALVE FOR NEW FORCEMAIN	G1	N/A	50	50		N/A	0	0	0	M	M	N/A	G		
BPV 11101	ALUM BACK PRESSURE VALVE	J1	N/A	25	25		N/A	0	0	0	M	M	N/A	G		
V 100001	EXISTING RAW SEWAGE FORCEMAIN ISOLATION	A	HANDWHEEL	350	350		OPEN	0	0	0	M	M	N/A	G		
VC 10301	P-10031 DISCHARGE CHECK VALVE	G1	N/A	300	300		OPEN	0	0	0	M	M	N/A			
VF 10002	NEW RAW SEWAGE FORCEMAIN ISOLATION	A	HANDWHEEL	300	300		CLOSED	0	0	0	M	M	N/A	G		
VF 10003	EXISTING RAW SEWAGE FORCEMAIN ISOLATION	A	HANDWHEEL	300	300		OPEN	0	0	0	M	M	N/A	G		
VF 10005	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	200	200		CLOSED	0	0	0	M	M	N/A	G		
VF 10006	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	200	200		CLOSED	0	0	0	M	M	N/A	G		
VF 10103	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	400	400		OPEN	0	0	0	M	M	N/A	G	PROVIDE EPOXY COATING. PROVIDE STEM EXTENSION AND VALVE BOX	
VF 10104	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	150	150		CLOSED	0	0	0	M	M	N/A	G	PROVIDE EPOXY COATING.	
VF 10104	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	150	150		CLOSED	0	0	0	M	M	N/A	G	PROVIDE EPOXY COATING.	
VF 10105	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	150	150		CLOSED	0	0	0	M	M	N/A	G	PROVIDE EPOXY COATING.	
VF 10203	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	400	400		OPEN	0	0	0	M	M	N/A	G	PROVIDE EPOXY COATING. PROVIDE STEM EXTENSION AND VALVE BOX	
VF 10204	RAW SEWAGE BYPASS ISOLATION	A	HANDWHEEL	150	150		CLOSED	0	0	0	M	M	N/A	G	PROVIDE EPOXY COATING.	
VF 10301	P-10031 DISCHARGE ISLOATION VALVE	A	HANDWHEEL	300	300		OPEN	0	0	0	M	M	N/A	G		
VF 11001	RAW SEWAGE FORCEMAIN ISOLATION	A	HANDWHEEL	300	300		CLOSED	0	0	0	M	M	N/A	G		
VF 11002	RAW SEWAGE FORCEMAIN ISOLATION	A	HANDWHEEL	350	350		OPEN	0	0	0	M	M	N/A	G		
VF 11003	RAW SEWAGE FORCEMAIN ISOLATION	A	HANDWHEEL	350	350		OPEN	0	0	0	M	M	N/A	G		
VPR 11101	ALUM PRESSURE RELIEF VALVE	J1	N/A	25	25		N/A	0	0	0	M	M	N/A	G		

FIELD WORK NOTATION

M = MECHANICAL CONTRACTOR
E = ELECTRICAL CONTRACTOR
G = GENERAL CONTRACTOR
EX = EXISTING EQUIPMENT

PLOT DATE: March 12, 2025 5:59:52 PM

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 Provide, test, and commission process valves complete with all noted accessories and actuators. The following specification is to be read in conjunction with the Valve Schedule, Valve Data Sheets and the Contract Drawings.

.2 Valves, operators and accessories shall be installed as shown on the Drawings and Specifications.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of the tender date.

.1 American Water Works Association (AWWA):

.1 AWWA C504, Rubber Seated Butterfly Valves.
.2 AWWA C508, Swing Check Valves for Waterworks Service 2” through 24” NPS.
.3 AWWA C512, Air-Release, Air/Vacuum and Combination Air Valves for Waterworks Services.
.4 AWWA C517, Resilient-Seated Cast-Iron Eccentric Plug Valves.
.5 AWWA C540, Power Acting Devices for Valves and Sluice Gates.
.6 AWWA C550, Protective Interior Coatings for Valves and Hydrants.
.7 AWWA C606, Grooved and Shouldered Joints.

.2 American Society of Mechanical Engineers (ASME):

.1 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
.2 ASME B16.5 - Pipe Flanges and Flanged Fittings.
.3 ASME B16.104 - Control Valve Seat Leaking.

.3 American Society for Testing and Materials (ASTM):

.1 ASTM A48 - Standard Specification for Gray Iron Castings.
.2 ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
.3 ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
.4 ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
.5 ASTM B124/B124M - Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes.
.6 ASTM A536 - Standard Specification for Ductile Iron Castings.
.7 ASTM A582/A582M-12e1 - Standard Specification for Free-Machining Stainless Steel Bars
.8 ASTM A743/A743M-13ae1 - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
.9 ASTM B16/B16M - Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
.10 ASTM B127 - Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet and Strip.
.11 ASTM B283/B283-14a - Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed).
.12 ASTM B584-14 - Standard Specification for Copper Alloy Sand Castings for General Applications.

.13 ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride((PVC) Compounds and Chlorinated Ploy (Vinyl Chloride) (CPVC) Compounds.
.14 ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
.15 ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.

.4 Canadian Gas Advisory Council (CGA):
.1 CGA 311-M88 (R2014) - Lever Operated Pressure Lubricated Plug Type Gas Shut-Off Valves.

.5 Canadian Standards Association (CSA):
.1 CSA B149.6 - Code for Digester Gas, Landfill Gas, and Biogas Generation and Utilization.

.6 Manufacturer's Standardization Society (MSS):
.1 MSS SP 61, Pressure Testing of Valves.
.2 MSS SP 110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

.7 National Sanitation Foundation (NSF) International:
.1 NSF/ANSI 61 - Drinking Water System Components – Health Effects.
.2 NSF/ANSI 61-372 - Drinking Water System Components – Lead Content.

.8 Occupational Health and Safety Act (OSHA).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted sections, submit the following for all PART 2 – PRODUCTS, including Valve Accessories.
.1 Product Data:
.1 Material of construction for all valve components illustrating compliance with the Valve Data Sheet, the Specification and relevant reference standards.
.2 Include information demonstrating that the valve and all its wetted components are chemically compatible with the proposed service fluid.
.3 Valve head loss and CV valves.
.4 Factory and field test results where required. Provide certified hydrostatic test results in accordance with manufacturer's standard procedures or MSS SP-61.
.5 AWWA Certification Documentation where applicable.
.2 Operations and Maintenance Data:
.1 Operation and Maintenance Manuals – refer to Division 1 for requirements. Provide one Operation and Maintenance Manual for each type of valve and operation supplied.
.2 Installation Requirements/Recommendations.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed valves.

1.6 QUALITY ASSURANCE

.1 Ensure that the supplied valves comply with the referenced standards noted in the Specifications and the Valve Data Sheets.

.2 All valves of the same type shall be from a single manufacturer.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 Provide training for each type of actuator

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

.2 Electric actuators to carry a two year warranty.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Include all valves indicated in the process valve schedule, process and instrumentation drawings (P&ID's), flow diagrams, or as noted in the contract drawings. A valve indicated on any one drawing is to be considered part of the Contract whether indicated on a corresponding plan, elevation, flow diagram or not. Generally, unless indicated otherwise, valves shown on the Mechanical Instrumentation Drawings (MID's) and the mechanical M drawings are not covered under this section.

.2 Generally, manual valves 50 mm in diameter and smaller are not scheduled.

.3 Alternate valves may be considered if demonstrated to be technically equal and there is a cost savings to the Owner. Alternates must be approved by Consultant prior to fabrication or ordering materials. Refer to Division 1.

.4 Unless otherwise indicated, all valves to have a 1035 kPa pressure rating.

.5 Unless specifically noted otherwise, valves to have the same nominal diameter and joining strategy as the connecting pipes and/or equipment.

.6 Provide all required appurtenances to ensure compatibility with valve and adjoining pipe and/or equipment.

.7 Factory mount operator, actuator and accessories. Coordinate actuator, operator and accessory orientation with site conditions, ensuring all controls and operators are accessed to the satisfaction of the Engineer. This includes but is not limited to on-site adjustments and modifications to the actuator, operator and accessory orientation to suit access to controls.

.8 Unless otherwise indicated, valves to have clockwise opening operation.

2.2 MANUAL ACTUATORS

.1 General:
- .1 Refer to the Valve Schedule and Valve Data Sheets for additional requirements.
- .2 Operator rim pull is not to exceed 36 kg (356 N) on handwheel and chain wheels. Maximum input of 17 nm on square nut.
- .3 Provide valve position indications on the actuator.
- .4 Provide actuators with combination 50 mm square nut and hand wheel for socket operation.
- .5 Actuators shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. All actuators will be designed to fully close the disc for full seating.
- .6 The manufacturer shall factory mount and test all actuators. Valve and actuator to be supplied as a single unit.
- .7 Unless otherwise noted, valves to open in the counterclockwise direction.

.2 Lever Type Actuator:
- .1 Lever actuator to be used on quarter turn valves, as noted in the Valve Schedule and Valve Data Sheets.
- .2 Lever actuators not to be used on valves over 150 mm.
- .3 Level actuator to be infinitely adjustable and lockable.
- .4 Lever actuator shall be fabricated of ASTM A536 Ductile Iron.

.3 Gear Type Actuators:
- .1 Gear type actuators complete with handwheel to be used on quarter turn valves not meeting the lever actuator requirements.
- .2 Fully enclosed scotch yoke type and worm gear type mechanisms permitted.
- .3 Scotch yoke type actuator (travelling nut):
  - .1 Actuator housing to be fully sealed and enclosed and constructed of ASTM A126 Cast Iron.
  - .2 Provide hardened steel gears with bronze pinion shaft operating in bronze bearings. Gear ratios shall not be less than AWWA C500, Table 7.

.4 Worm gear type actuator:
- .1 Actuator housing to be fully sealed and constructed of ASTM A536 Ductile Iron.
- .2 Ductile iron or bronze worm gear.

.5 Actuator to be painted to match associated valve.

.6 Actuator to have adjustable travel stop.

2.3 VALVE ACCESSORIES

.1 Chain Wheels
- .1 Provide guided chain with galvanized or stainless steel coil proof chain. Chain to be selected by valve manufacturer.
- .2 Chain wheels to be adjustable and detachable
- .3 Chains to be complete with hooks and tie back anchors. Install chains so as not to impeded path of egress.
- .4 Standard of Acceptance: Dezurik CW

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

.1 Install valves in accordance with:
- .1 The valve manufacturer's written instructions.
- .2 The connecting pipe manufacturer's written instructions.

.2 All valves to be located such that they are accessible.

.3 Valves/pipes to be supported such that there are no pipe loads transferred to the valve.

.4 Provide chainwheel actuators on all valves located at least 2 m above the finished floor. Refer also to valve data sheets. Provide 304 or 316 stainless steel tie backs where chain would otherwise interfere with normal operator travel.

.5 Pressure testing of valves to be performed in conjunction with Pressure Testing Requirements of the adjoining process pipe. Refer to Section 15030 for additional requirements.

3.2 SUPPLEMENTS

.1 The Valve Schedule is included as part of this section. It is intended to serve as a guide to the type and size of valve required. Where a valve is indicated on the drawings, but not listed herein, select a valve to match a similar service listed herein. Not all small valves such as drains or instrument isolation are listed, valves not listed must be provided as specified elsewhere. Valves clearly indicated on the drawings are not listed here or specified elsewhere to be assumed as new and similar to a valve with a similar function.

The following Data Sheets are included as part of this section.

- .1 Plug Valves:
  - .1 Eccentric Plug Valves: Data Sheet 15100-A.
- .2 Ball Valves:
  - .1 Regular Service Ball Valves: Data Sheet 15100-D.
  - .2 Plastic PVC Ball Valves: Data Sheet 15100-D3.
- .3 Check Valves:
  - .1 Swing Check Valves: Data Sheet 15100-E.
- .4 Air Release Valves:
  - .1 Air Release Valve (Sewage): Data Sheet 15100-G1.
- .5 Relief Valves:
  - .1 PVC Pressure Relief Valves: Data Sheet 15100-J1.

END OF SECTION

General	Non-lubricated bubble tight bi-directional valve. Valve sizes per drawings and valve schedule. End Connections: Flanges: ASMEB16.1 Class 125 or Grooved in accordance with AWWA C606.
Code/Standard Compliance	AWWA C517 (latest edition)
Pressure/Temperature Rating	1210kPa for valves up to 300mm and 1035kPa for valves larger than 300mm. Temperature rating:-29-82 ºC
Body	ASTM A126 Class B Cast Iron or A536 Ductile Iron. All exposed bolts, washers, springs, and nuts to be stainless steel.
Plug	Full round or 100% rectangular port plug to be fabricated monolithically of cast or ductile iron. Plug facing to be chloroprene or Buna-N to AWWA C517 Standard.
Seat	Raised welded nickel plug seat.
Packing	Adjustable Buna-N chevron packing ring or “U” cup type. Packing to be easily accessible for inspection, adjustment, and/or replacement without removing the bonnet or removing the valve from service. Packing gland to be ASTM A126 Class B Cast Iron with stainless steel bolting hardware. Provide PTFE or Buna-N journal grit seals.
Bearings	Journal bearings shall be provided at each end of the plug. Fabricated of wetted oil impregnated ASTM A-743 stainless steel or ASTM B-127 bronze, to AWWA C517 standard
Coating	Exposed valves to be coated to Division 09900 and 15020 standards Epoxy coating required where indicated in the valve schedule External epoxy coating required for buried and/or submerged service. Epoxy coating to be two part epoxy spray, 8 mil thick, conforming to AWWA C550.
Manual Operator	Refer to valve schedule and specifications for additional requirements Valves less then 100mm to have infinitely adjustable lockable ASTM A536 ductile iron lever actuator. Valves 100mm and over to have totally enclosed worm gear actuator c/w hand wheel. Grease fittings required for each actuator bearing. Fully grease packed actuator bearings are acceptable.
Power Operators	Refer to valve schedule and specifications for requirements
Accessories	Refer to valve schedule and specifications for additional requirements. Valve tag denoting specific valve identity number consistent with the project P&ID drawings and Specification Section 15020 requirements.
Specified Product	**Dezurik PEF Plug Valve**
Approved Alternates	**Henry-Pratt Ballcentric Plug Valve** **Valmatic Series 5800R**
Application	Raw sewage, Municipal wastewater sludge. Where indicated on drawings and in the valve schedule.
Execution: • Install valve to manufacturer’s recommendations. • Plug valves to be installed with stem horizontal.	

General	Full port bi-directional True Union PVC ball valve. Minimum suffix “A” designation for chemical resistance rating to ASTM D-1784. Valve sizes per drawings and valve schedule. End connections: Schedule 80 Socket connection to ASTM D-2467 or Flanged to ASME Class 150 bolt pattern using one piece moulded fabrication.
Pressure/Temperature Rating	Pressure : 1585 kPa @ 20 ºC and 1035 kPa @ 50 ºC Temperature range: 0-60 ºC
Body	Single piece PVC construction c/w ISO standard actuator mounting platform.
Ball	PVC construction.
Seat	Polytetrafluoroethylene(PTFE)
Stem	PVC construction, blow out proof design c/w double O-Ring seals.
Manual Operator	PVC lever actuator which doubles as a valve servicing tool. Lockable handle.
Power Operators	Refer to valve schedule and specifications for requirements
Accessories	Valve to be c/w base mounting inserts. Vented ball required on off gassing chemicals including sodium hypochlorite Refer to valve schedule and specifications for additional requirements Valve tag denoting specific valve identity number consistent with the project P&ID drawings and Specification Section 15020 requirements.
Specified Product	**Chemline Type 21**
Approved Alternates	**Georg Fisher Type 546**
Application	General water service 50mm and larger Used on the following water/wastewater chemical processes: Alum and Ferric based coagulants Where indicated on drawings and in the valve schedule

Execution:

- Install valve to manufacturers recommendations
- For solvent welded installations ensure that the solvent used is compatible and recommended by the piping and/or valve manufacturer for use with the specific chemical being transported in the pipe/system.

General	2-way general service, cold non shock bronze or brass ball valve. Valve sizes per drawings and valve schedule. End connections: Threaded NPT or soldered
Code/Standard Compliance	MSS-SP-110
Pressure/Temperature Rating	Pressure (CWP): 2750 kPa Temperature rating: -29 to 100 ºC
Body	2 piece construction. Bronze body to ASTM B584. Brass body to B283, Polytetrafluoroethylene (PTFE) body seal.
Ball	ASTM 276 stainless steel 316 ball or ASTM B16 brass chromium plated
Seat	Polytetrafluoroethylene.(PTFE)
Stem	Blow out proof ASTM B16 brass stem
Packing	Modified Polytetrafluoroethylene(MPTFE) c/w adjustable bronze or brass or stainless steel packing gland or double O ring design NBR/FPM
Stem Bearing	Reinforced Polytetrafluoroethylene.(RPTFE)
Manual Operator	Stainless steel high rise lever. Latch lock.
Accessories	Refer to valve schedule and specifications for additional requirements Valve tag denoting specific valve identity number consistent with the project P&ID drawings and Specification Section 15020 requirements. Provide stem extension were required.
Specified Product	**Apollo 70-10X-04 Series, 77C-10X-04 Series**
Approved Alternates	**Kitz 68AMLL, 69AMLL** **Nibco T-585-66-LF, S-585-66-LF**
Application	General water service General air service Where indicated on drawings and in the valve schedule
Execution: • Install valve to manufacturer’s recommendations.	

General	Air cushion swing check valve to AWWA C508. Valve sizes per drawings and valve schedule. Valve to be designed to allow field conversion of the closure device End connections: Flanges to ASME B16.1 Class 125
Code/Standard Compliance	AWWA C508 (latest edition) NSF 61 for potable water
Pressure/Temperature Rating	Pressure rating: 1375kPa Temperature 20°C
Body	ASTM A126 grade B cast iron.
Disk	ASTM A126 grade B cast iron.
Shaft	ASTM A743 Stainless Steel supported at both ends.
Seat	ASTM A743 316 Stainless Steel
Disk Seat	Buna-N
Lever	Lever and adjustable weight to be ASTM A536 ductile iron or cast iron and mountable on either side of the valve.
Cylinder	Cast Bronze or aluminum cylinder externally attached to either side of the valve provide adjustability of the valve closure rate. .
Coating	Exposed valves to be coated to Division 09900 and 15020 standards Epoxy coating required where indicated in the valve schedule. Epoxy coating to be 8 mil 2-part epoxy or heat activated fusion bonded epoxy conforming to AWWA C550. When used in potable water applications, epoxy coatings to be NSF-61 certified.
Accessories	Refer to valve schedule and specifications for additional requirements Valve tag denoting specific valve identity number consistent with the project P&ID drawings and Specification Section 15020 requirements.
Specified Product	**Apco Series CVS-250A**
Approved Alternates	**Henry Pratt Series 9001** **Golden Anderson 250-DS**
Application	Water, Wastewater (liquid train) Where indicated on drawings and in the valve schedule

Execution:

- Install valve to manufacturer’s recommendations.
- Ensure that a protective cage, installed to OSHA standards is installed around the lever/weight assembly.

General	Single body double orifice low profile combination air/vacuum relief valve. Valve sizes per drawings and valve schedule. End connection: Threaded NPT or flanged to meet ASME B16.1 Class 125
Code/Standard Compliance	AWWA C-512
Pressure/Temperature Rating	Pressure rating: 1035 kPa Temperature rating: 100ºC
Body	ASTM A126 Class B Cast Iron or ASTM A536 Ductile Iron or ASTM A743 or 316 Stainless Steel
Float	Concave design constructed of ASTM A240 Stainless Steel
Needle	Buna-N rubber compound
Seat	Design for drip tight shut off. Buna-N rubber compound construction
Internal Linkage	ASTM A126 Class B Cast Iron or Delrin Thermoplastic to ASTM D4181
Plug	Stainless steel ASTM A240 T304 or ASTM B124 Brass.
Coating	Exposed valves to be coated to Division 09900 and 15020 standards
Accessories	Inlet shut off valve
Specified Product	**APCO Valve 440**
Approved Alternates	**Valmatic Series 800** **Crispin X Series, US Series**
Application	Where indicated on drawings and in the valve schedule. • Sewage force mains
Execution: • Install valve to manufacturer’s recommendations.	

General	Dual purpose True Union PVC backpressure and relief valve c/w integral directional flow control. Low hysteresis valve design. Minimum suffix “A” designation for chemical resistance rating to ASTM D-1784. Valve sizes per drawings and valve schedule. End connections: Schedule 80 Socket connection to ASTM D-2467 or Flanged to ASME Class 150 bolt pattern using one piece moulded fabrication.
Pressure/Temperature Rating	Pressure : 1035 kPa @ 20 ºC and 410 kPa @ 40 ºC Temperature range: 0-50 ºC
Set Pressure Range	Valves up to 50mm: 35kPa to 900kPa Valves 50mm to 65mm: 50kPa to 900kPa Valve 100mm: 35kPa to 620kPa
Body	PVC construction
Bonnet & Piston	PVC or construction
Seat	EPDM
Seals	EPDM or Viton
Control Diaphragm	PTFE bonded EPDM
Spring	Galvanized spring steel
Manual Operator	Manually operated 304 stainless steel spring tensioning bolt.
Accessories	Valve to be c/w base mounting inserts. Refer to valve schedule and specifications for additional requirements Valve tag denoting specific valve identity number consistent with the project P&ID drawings and Specification Section 15020 requirements.
Specified Product	**Chemline SB 12**
Approved Alternates	**Georg Fisher 586**
Application	Used on the following water/wastewater chemical processes Alum and Ferric based coagulants Where indicated on drawings and in the valve schedule

Execution:

- Install valve to manufacturer’s recommendations.
- For solvent welded installations ensure that the solvent used is compatible and recommended by the piping and/or valve manufacturer for use with the specific chemical being transported in the pipe/system.

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 The following section covers the vibration control and seismic control measures required to accommodate the installation of all mechanical components.

.2 The Contractor is to retain the services of a third party Structural Engineer licensed in the province of Ontario to provide the vibration control and seismic restrain design and installation review for all the mechanical equipment and appurtenances to the requirements noted herein.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.

- .1 American Society of Mechanical Engineers (ASME):
  - .1 ASME B16.5 - Pipe Flanges and Flanged Fittings.
  - .2 ASME B16.11- Forged Fittings, Socket Welding and threaded
- .2 Ontario Building Code.
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .4 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Divisions 1 and 15.

.2 In addition to the submittal requirements identified in the above-noted sections, submit the following for all PART 2 – PRODUCTS.

- .1 Provide separate shop drawings for each isolated system as well as system shop drawings complete with performance and product data.
- .2 Provide detailed drawings of all seismic control measures for equipment, piping and ductwork.
- .3 Shop drawings to be reviewed, approved, and sealed by the Contractor's Structural Engineer responsible for design of supports, anchors and restraints prior to submission to Consultant.
- .4 Submit certified test data to Consultant detailing performance of vibration isolation and seismic.

.3 Submit complete report of testing results including sound curves

1.4 CLOSE OUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed equipment.

1.6 QUALITY ASSURANCE

.1 Vibration control measures to conform to the latest edition of the ASHRAE standards for vibration control and isolation.

.2 Seismic control measures to conform to the latest edition of the following standards:
  .1 Ontario Building Code.
  .2 ASHRAE and SMACNA Standards for Seismic Restraint.

.3 Supports, anchors and restraints are to conform to and be coordinated with the requirements of the Project Structural Engineer and the Contractor's Structural Engineer responsible for the design of structural support systems for mechanical systems and equipment.

.4 Contractor to provide all necessary information on equipment, pipe support and duct support requirements to the vibration and seismic control manufacturer.

.5 Equipment vibration control devices, seismic control devices and equipment bases are to be from one manufacturer.
  .1 Standard of Acceptance: Mason Industries.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

.2 Experienced and competent sound and vibration testing professional engineer to take vibration measurements for HVAC systems after start up and TAB of systems to Section 15030 – Testing and Section 15031 – Balancing Mechanical Systems.

.3 Provide Consultant with notice 48 h in advance of commencement of tests.

.4 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and, where appropriate, provide remedial recommendations (including sound curves).

.5 Prepare and submit complete report of test results including sound curves.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

1.10 SEISMIC DESIGN PARAMETERS

.1 Seismic Site Class:
  .1 Seismic Site Class ‘C’.
  .2 Sa(0.2) = 0.580.
  .3 Post-disaster importance category Ie = 1.5.
  .4 Cp, Ar and Rp as per OBC Table 4.1.8.18.
  Rp = 1.0 for flexible components and non-ductile connections, Rp = 1.5 for shallow and non-ductile connections.

PART 2 - PRODUCTS

2.1 RUBBER PAD ISOLATORS

.1 Two (2) layers of 19 mm thick neoprene pad separated horizontally by a 1.5 mm galvanized shim.

.2 Provide load distribution plates as required.

2.2 NEOPRENE ISOLATOR

.1 Neoprene mounting with a minimum static deflection of 50 mm and all directional seismic capability. Neoprene to be bridge-bearing quality.

.2 Ductile iron casting with two separated and opposing molded neoprene elements. Elements to prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.

2.3 SHEET METAL SUPPORT ATTACHMENT ISOLATORS

.1 Neoprene bushing cushioned between two (2) steel sleeves. Neoprene to be bridge bearing quality.

.2 Steel disc and outer sleeve to act as stop so tightening of bolt does not interfere with panel isolation.

2.4 OPEN SPRING ISOLATORS

.1 Free standing and laterally stable (without housing), complete with molded neoprene cup or 6 mm neoprene acoustical friction pad between the baseplate and the support and leveling bolts.

.2 Spring diameters to be no less than 80% of the compressed height of the spring at rated load.

.3 Springs to have minimum additional travel to solid equal to 50% of the rated deflection.

2.5 RESTRAINED SPRING ISOLATOR

.1 Spring isolator with rigid housing that includes vertical limit stops to prevent spring extension when load is removed. Designed to suit seismic loads.

.2 Maintain minimum clearance of 12 mm travel in all directions before contacting resilient snubbing collars.

.3 Provide 6 mm neoprene acoustical friction pad bonded to the baseplate.

.4 Spring diameters to be no less than 80% of the compressed height of the spring at rated load and springs are to have a minimum additional travel to solid equal to 50% of the rated deflection.

2.6 HOUSED SPRING ISOLATORS

.1 Springs to be mounted in a ductile iron or steel which will housing to provide all directional seismic snubbing.

.2 Provide vertical adjustment, allowing a maximum 6 mm travel in all directions before contacting the resilient snubbing collars.

.3 Spring diameters to be no less than 80% of the compressed height of the spring at rated load and springs are to have a minimum additional travel to solid equal to 50% of the rated deflection.

2.7 SPRING AND NEOPRENE HANGER

.1 Rigid steel frames with minimum 32 mm thick neoprene elements at top and a steel spring seated in a steel washer neoprene cup on the bottom. Neoprene bushings to extend into steel housing.

.2 Spring diameters and hanger box lower hole sizes to permit the hanger rod to swing through a 30° arc before contacting the rod bushing and short circuiting the spring.

.3 Spring diameters to be no less than 80% of the compressed height of the spring at rated load and springs are to have a minimum additional travel to solid equal to 50% of the rated deflection.

2.8 PRE-COMPRESSED SPRING AND NEOPRENE HANGER

.1 Neoprene and spring hanger to be pre-compressed and locked at the rated deflection by a resilient seismic up-stop to maintain a fixed elevation during installation.

.2 Provide deflection scale on housing and release mechanism to free spring.

2.9 HORIZONTAL THRUST RESTRAINT

.1 Provide spring element in series with neoprene molded cup and provisions for factory preset and field adjustment for a maximum 6 mm movement at start and stop.

.2 Provide rod and angle brackets for attachment to equipment and ductwork or structure. Locate at the centre line of thrust and symmetrically on either side of equipment.

2.10 SEISMIC CABLE RESTRAINTS

.1 Galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two (2), arranged to provide all directional restraint.

.2 Cable end connections to be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.

2.11 SEISMIC SOLID BRACE

.1 Steel angles or channels to resist seismic loads with a minimum safety factor of two (2) arranged to provide all directional restraint.

.2 End connectors to be steel assemblies that swivel to the final installation angle and utilize two (2)

through bolts to provide proper attachment.

2.12 HANGER SEISMIC RESTRAIN CLAMPS

.1 Steel angles, sized to prevent buckling, to be clamped on support rods.

.2 Utilize a minimum of three (3) ductile iron clamps at each restraint location.

2.13 CLEVIS SEISMIC BRACES

.1 Clevis hanger cross-bolt braces of preformed channels, bolted across the clevis cross bolt.

2.14 SEISMIC SNUBBERS

.1 Interlocking steel members restrained by a shock absorbent rubber material compounded to bridge bearing specifications with a gap of 3 mm to 6 mm between hard and resilient surfaces.

.2 Elastomeric materials to be replaceable and a minimum 19 mm thick.

2.15 ACOUSTICAL PIPE ANCHORS AND GUIDES

.1 Pipe anchors to consist of two sizes of steel tubing separated by a minimum of 12 mm thick, 60 durometer neoprene. Allowable loads not to exceed 3450 kPa.

.2 Pipe guides to consist of a telescoping arrangement of two sizes of steel tubing separated by 12 mm thick 60 durometer neoprene. Provide removable shear pins to preset and adjust height of guide to suit vertical movement due to expansion or contraction.

2.16 MOLDED FLEXIBLE PIPING/PUMP CONNECTORS

.1 Flexible spherical expansion joints of multi-layered polyester (DuPont Kevlar) tire chord fabric reinforcement with peroxide cured EPDM cover, liner and chord frictioning.

.2 Solid steel rings within the raised face rubber flanged ends to prevent pullout. Double sphere connections to be provided with a ductile iron external ring reinforcement between spheres.

.3 Flanges to be split ductile iron or steel with hooked or similar interlocks.

.4 Rated at 1.72 MPa at 77°C with a uniform drop in allowable pressure to 1.48 MPa at 121°C in all sizes to 350 mm diameter. Safety factors for burst and flange pullout to a minimum of 3/1.

.5 Provide control rods at unanchored locations where required.

2.17 METAL HOSE PIPING/PUMP CONNECTORS

.1 Stainless steel, braided outer core, inner core with annular corrugation, rated for 2070 kPa operation.

.2 Provide with carbon steel flanged ends to ANSI B16.5 for piping 60 mm diameter and larger, screwed ends to ANSI B16.11 for piping 50 mm and smaller.

.3 Use minimum end to end dimension of 300 mm for 20 mm service.

2.18 STRUCTURAL BASES

.1 Provide structural bases to maintain alignment of component parts (motors, drives, equipment, isolators) and to support equipment, vibration isolation and seismic restraint devices.

.2 Pump bases to include support for suction and discharge elbows for split case pumps.

.3 Structure to be suitable for all starting and operating forces without misalignment and flexing.

.4 Structure to be suitable for seismic restraint to maintain support and alignment during a seismic event. Perimeter members to be steel beams with a minimum depth equal to 1/10 of the longest base dimension.

.5 Motor slide rails to be integral with base.

.6 Isolator attachments to minimize height and maintain a minimum 25 mm clear space between sub-base and structural base.

2.19 STRUCTURAL RAILS

.1 Provide structural rails to support equipment, vibration isolation and seismic restraint devices where a unitary base is not required for equipment alignment.

.2 Structure to be suitable for all starting and operating forces and to maintain support during a seismic event.

.3 Isolator attachments to minimize height and maintain a minimum 25 mm clear space between sub-base and structural rails.

2.20 REINFORCED CONCRETE INERTIA BASES

.1 Provide reinforced concrete in entire base to maintain alignment of component parts (motors, drives, equipment, isolators) and to support equipment, vibration isolation and seismic control devices.

.2 Bases for split case pumps to be large enough for suction and discharge elbow support.

.3 Structure to be suitable for all starting and operating forces, without misalignment and flexing.

.4 Structure to be suitable for seismic restraint to maintain support and alignment during a seismic event.

.5 Encase reinforced concrete inertia slabs in a steel channel frame with 1.2 mm sheet metal bottom.

.6 Isolator attachments to minimize base height and maintain 25 mm clear space between sub-base and inertia base.

.7 Provide inertia base with concrete of 2400 kg/m³ density for:

5.6 kW and under	150 mm thick
7.5 kW to 18.7 kW	200 mm thick
22.4 kW to 44.8 kW	250 mm thick
56 kW and over	300 mm thick

.8 Reinforce base with 10 mm reinforcing bars for 150 mm and 200 mm bases and 15 mm with 250 mm and 300 mm bases. Space all bars 300 mm o.c. in both directions of the horizontal plane and weld in place.

2.21 SUB-BASES

.1 Install isolation material on 100 mm thick concrete sub-base.

.2 Coordinate operating static deflections with detailed equipment schedule and manufacturer's requirements.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install vibration isolation equipment in accordance with manufacturer’s instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Coordinate vibration isolation and seismic restraint with structural, architectural and electrical building systems. Provide support and restraint as required to suit seismic design.

.4 Inspect complete installation on system start-up and report in writing to Consultant changes necessary to prevent short circuit transmission. Perform changes necessary to eliminate short circuiting or to increase vibration isolation efficiency.

3.2 EQUIPMENT BASE AND VIBRATION ISOLATOR APPLICATION

.1 Small Ducted Fans, Fan Powered Terminal Units
- .1 No base, isolators attached directly to equipment: all equipment.
- .2 Open Spring Isolators or Hangers: all equipment.
- .3 Minimum Isolator Deflection:
  - .1 13 mm: up to 285 L/s
  - .2 19 mm: above 285 L/s

.2 Pumps
- .1 No base, isolators attached directly to equipment: all inline pump installations.

.3 Boilers - Fire Tube
- .1 No base, isolators attached directly to equipment: all installations.

.2 Restrained Spring Isolators: all above grade installations.

.3 Minimum Isolator Deflection:

.1 6 mm: all slab-on-grade installations.

.2 19 mm: all above grade installations.

3.3 PIPING SYSTEM VIBRATION ISOLATION

.1 Refer to Section 15060.

.2 Provide vibration isolation within 15 m of vibrating equipment.

.3 Suspended Piping: first three (3) hangers to have the same deflection as the equipment isolators with a maximum deflection of 50 mm. The remaining hangers are to be spring or a combination of rubber and spring hangers with a deflection of 20 mm.

.4 Floor Supports: first two (2) floor support isolators to be restrained spring type with a blocking feature to prevent load transfer to equipment as the piping is filled or drained. Provide a slide plate on top of the isolator where pipe is subject to larger thermal movement.

.5 Riser Supports, Anchors and Guides: isolate to standards for piping system.

.6 Piping Penetrations: seal all openings with acoustical barrier such as fibrous material and caulking or fabricated mechanical seal.

.7 Flexible Pipe Connectors: provide flexible pipe connectors to permit isolators to function properly, to protect equipment for strain from misalignment/ expansion/contraction and to attenuate noise and vibration transmission along the piping. Provide restraint to counteract thrust and limit movement.

3.4 DUCT SYSTEM VIBRATION ISOLATION

.1 Flexible Duct Connectors: provide canvas and rubber duct connections at all fan and air handling unit/makeup air unit intakes and discharges. Provide thrust restraints to maintain flexible connection slack condition.

3.5 SEISMIC CONTROL MEASURES

.1 General:

.1 The facility will be considered a “post disaster” facility per the OBC. The following systems must remain in operation post-disaster to maintain minimum treatment:

.1 Raw Sewage Pumps

.2 The following chemical feed systems:

.1 Alum

.3 Hot water heating boilers, circulation pumps, piping and ancillaries.

.2 The above does not preclude other requirements of this section and other regulatory requirements.

.3 All systems and/or equipment are to remain in position during and after an earthquake so as not to jeopardize occupants or impede safe exiting.

.4 Seismic control systems to work in all directions.

.5 Fasteners and attachment points to resist same maximum load as seismic restraint.
.6 Drilled or power driven anchors and fasteners not permitted.
.7 No equipment, equipment supports or mounts to fail before failure of structure.
.8 Supports fabricated using cast iron or threaded pipe not permitted.
.9 Seismic control measures not to interfere with integrity of fire stopping.

.2 Static equipment:
.1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
.2 Suspended equipment:
.1 Use one or more of following methods depending upon site conditions and as indicated:
.1 Install tight to structure.
.2 Cross brace in all directions.
.3 Brace back to structure.
.4 Cable restraint system.
.3 Seismic restraints:
.1 Cushioning action to be gentle and steady.
.2 Shall never reach metal-like stiffness. Vibration isolated equipment:

.3 Vibration isolated equipment:
.1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
.2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.

.4 Piping systems:
.1 All other piping systems: hangers longer than 300 mm; brace at each hanger.
.2 To be compatible with requirements for anchoring and guiding of piping systems.

.5 Bracing methods:
.1 Approved by Consultant.
.2 Structural angles or channels.
.3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 The following specification pertains to all Division 11 and Division 15 ducting that require insulation.

.2 The drawings may contain additional insulation requirements.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
- .1 Thermal Insulation Association of Canada (TIAC)
- .2 TIAC Best Practices Guide .
- .3 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1: SI Edition, Energy Standard for Buildings except Low-Rise Residential Buildings.
- .4 American Society for Testing and Materials (ASTM):
  - .1 ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
  - .2 ASTM C 335: Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C411: Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
  - .4 ASTM C 449/C 449M: Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C 533: Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
  - .6 ASTM C 534: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
  - .7 ASTM C 547: Standard Specification for Mineral Fiber Pipe Insulation.
  - .8 ASTM C 553: Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .9 ASTM C 612: Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .10 ASTM C 795: Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .11 ASTM C 921: Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - .12 ASTM E 84: Standard Test Methods for Surface Burning Characteristics of Building Materials.
  - .13 ASTM E 96: Standard Test Methods for Water Vapor Transmission of Materials
- .5 National Fire Protection Association (NFPA)
  - .1 NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems
  - .2 NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Material

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 51.9: Mineral Fibre Thermal Insulation for Piping and Round Ducting
- .2 CGSB 51.10: Thermal Insulation, Mineral Fiber, Block or Board, for Ducting, Machinery and Boilers
- .3 CGSB 51-GP-52MA Vapour Barrier, Jacket and Facing Material for Pipe, Duct, and Equipment Thermal Insulation

.4 CGSB 51.53: Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.4 Underwriters Laboratories of Canada (ULC)
.1 CAN/ULC-S102: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.2 UL-723: Standard for Test for Surface Burning Characteristics of Building Materials

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Divisions 1 and 15.

.2 In addition to the submittal requirements identified in the above-noted sections, submit the following for all PART 2 – PRODUCTS.
.1 Performance data for each insulation type.
.2 Submit TIAC installation method from published standard clearly listing which service each installation method will apply to. Note variances from published standard.
.3 Provide copies WHMIS MSDS - Material Safety Data Sheets in accordance with Division 1 where material specified has MSDS Sheets.

.3 Submit samples/mock up where requested.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 Not Applicable

1.6 QUALITY ASSURANCE

.1 Provide insulation to NFPA Standard 90A, and 255, Latest edition; as well as UL-723 Latest edition fire hazard ratings.

.2 Unless indicated otherwise all insulation to be installed to published standards of Thermal Insulation Association of Canada (TIAC).

.3 Flameproofing treatment to withstand high humidity conditions without deterioration.

.4 Performance Requirements defined: Catalogued or published ratings for manufactured items obtained from tests carried out by manufacturer or those ordered by manufacturer from an independent testing agency signifying adherence to codes and standard and standardized testing of performance criteria.

.5 The contractor performing the work of this section shall be a recognized installer of insulation systems and have a minimum of five (5) years experience which can be documented and verified.

The contractor shall be a current and listed member of TIAC (Thermal Insulation Association of Canada).

.7 Where applicable products shall bear a ULC or UL label.

.8 Contractor to complete sample installation in the field for Consultant's review prior to proceeding with the work. Sample installation to include straight pipe, one valve, a tee or elbow and a mechanical piping joint.

.6 Conform to the latest edition of the Ontario Building Code, ASTM 411 and ULC requirements.

1.7 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Provide adhesives, sealers, vapour coating, mastics, laggings and bedding compounds compatible with materials to which they are applied.

.2 Material not to soften, corrode or otherwise deteriorate in either wet or dry state and be type recommended by manufacturer as suitable for proposed application.

2.2 MATERIAL THICKNESS

.1 Insulation system thickness for the following operating temperatures:

Insulation Thickness	Operating Temperature
50 mm in 2 layers	-40°C to 0°C
25 mm	0°C to 65°C

2.3 GLASS FIBRE INSULATION TYPE ID-2

.1 Material: glass fibre, rigid board type, to CGSB 51-GP-10M.

.2 Density: 72 kg/m³.

.3 Temperature rating: to 120°C.

.4 Conductivity: 0.032 W/m/°C.

.5 Facing: RFFRK, factory applied facing of reinforced foil-faced flame resistant Kraft paper.

.6 Fastenings:
- .1 Mechanical fasteners, welded pins, speed washers or clips.
- .2 Tape: 100 mm wide, self-adhesive RFFRK.

.7 Standard of Acceptance:
.1 Knauf.
.2 Manson.
.3 Fibrex.

2.4 COVERING / JACKETS

.1 Canvas: compact, firm, heavy, plain weave cotton fabric: 200 g/m².
.1 Standard of Acceptance:
.1 Fattal.
.2 Thermocanvas.

.2 Aluminum: embossed corrugated aluminum sheet, 0.4 m thick, mechanical fasteners.
.1 Standard of Acceptance: Childers.

2.5 FASTENINGS AND SUPPORTS

.1 Weld pins 3 mm mild steel, length as required to suit insulation, with 32 mm x 32 mm plated clips nylon stops.

2.6 FACING MATERIALS

.1 Vapour barrier jacket and facing material to CGSB 51-GP-52 for duct thermal insulation.

PART 3 - EXECUTION

3.1 GENERAL

.1 Insulate all ducting not at ambient temperature to prevent surface condensation and to keep surface temperature below 70°C.
.1 Insulate all outside air ductwork up to coil or factory insulated air-handling unit (thickness 50 mm).
.2 Insulate exhaust only from outside wall to 300 mm past exhaust damper (i.e., 300 mm on warm side of damper or 900 mm from outside wall), (thickness 50 mm).
.3 Insulate all outside air intakes, not provided with a coil, up to point where air discharges to space (thickness 50 mm).

.2 Provide Type ID-2 for all rectangular duct exposed to outside air and as outlined below unless indicated to a greater extent on drawings.

3.2 EXTERIOR JACKET

.1 Provide aluminum jacket for insulated ducting in process areas and in electrical room.

3.3 INSTALLATION

.1 Prior to installation ensure that:
- .1 Surfaces to be covered are clean and dry;
- .2 Insulation is clean and dry.

.2 Application
- .1 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.
- .2 Duct insulation with vapour barrier to be continuous.

.3 Joints:
- .1 Place joints on top of duct.
- .2 Adhere and seal laps of vapour barrier cover or vapour barrier strip of 75 mm minimum width furnished with insulation, using vapour seal adhesives.
- .3 Stagger both longitudinal and horizontal joints, on duct insulation of multi-layered construction.
- .4 Rectangular ductwork: cover with rigid glass fibre insulation and at least 50 mm overlapping seams located where least visible. Use adhesive lagging to secure overlapping edges, provide over vapour barrier jacket or coating.

END OF SECTION

SYSTEM IDENTIFIER		PIPE MATERIAL	COMMENT
PROCESS PIPING			
RSE	Raw Sewage	SS-1	
OF	Overflow	SS-1; PVC-1	
DR	Drain	SS-1; PVC-1	
VNT	Vent		(2)
CHEMICAL PIPING			
AL	Aluminum Sulfate (Alum)	PVC-1; (Flex 1)	(1)

GENERAL NOTES:

- The drawings identify the material class associated with a particular pipe. The Process Pipe Schedule defines the pipe material to be used and references the Pipe Data Sheets for detailed pipe specification and alternate material options.
- The Process Piping Schedule does not preclude individual specification requirements.
- In the event of conflict, the Process Pipe Schedule will supersede the Data Sheets and the Drawings.

SCHEDULE NOTES:

(1) Material in parenthesis required for connection to equipment and/or tankage.
(2) Material as indicated on Drawings or per related process fluid as approved by Consultant.

Application	• Where indicated in the Contract Documents. • Flex-1 may be used for the following services: (i) Aluminum Sulphate		
Design Pressure	510 kPa (75 psi)		
Design Temperature	20°C (70°F)		
Testing Requirements	Refer to Section 15030		
Item	**Size (mm)**	**Description**	**Notes**
Tube	6 - 50	Clear Industrial Polyvinyl Chloride Longitudinally Reinforced with Spiral Wound Polyester Tubing to Have a 75 Durometer Hardness Rating Fabco Clear Nylon Braided Tubing or Equal	(1)
Fittings	6 - 50	Polypropylene Insert and Cam Coupler Fittings as Required Double Stainless Steel Hose Clamps Required at Each Fitting	

GENERAL NOTES:

- Tubing to be confirmed chemically suitable for long term exposure to the service medium.
- Used to connect equipment and/or tankage to rigid piping or as detailed on the drawings.

SCHEDULE NOTES:

(1) Horizontal runs to be routed in containment pipes or in trays. Refer to Section 11240.

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 Supply, install and test all process piping and related appurtenances in accordance with the Contract Documents.

.2 This section covers process piping, both above and below grade which typically extends 1m beyond the outer perimeter of building structures (unless specifically noted otherwise). Beyond this point refer to Division 2 for yard piping details.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of the project tender date.

- .1 American Iron and Steel Institute (AISI).
- .2 American Society of Mechanical Engineers (ASME):
  - .1 ASME-B1.20.1 - Pipe Threads, General Purpose, Inch.
  - .2 ASME-B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
  - .3 ASME-B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard.
  - .4 ASME-B16-11 - Forged Fittings, Socket-Welding and Threaded.
  - .5 ASME-B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
  - .6 ASME-B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
  - .7 ASME-B31.1 - Power Piping.
  - .8 ASME-B31.3 - Process Piping.
  - .9 ASME-B36.10 - Welded and Seamless Wrought Steel Pipe.
  - .10 ASME-B36-19 - Stainless Steel Pipe.
- .3 American Society for Testing Materials (ASTM):
  - .1 ASTM A47 - Ferritic Malleable Iron Castings.
  - .2 ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - .3 ASTM A105 - Carbon Steel Forgings for Piping Applications.
  - .4 ASTM A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
  - .5 ASTM A182 - Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
  - .6 ASTM A193 - Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose.
  - .7 ASTM A194 - Carbon Steel, Alloy Steel and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  - .8 ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - .9 ASTM A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - .10 ASTM A380 - Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
  - .11 ASTM A403 - Wrought Austenitic Stainless Steel Piping Fittings.
  - .12 ASTM A536 - Standard Specification for Ductile Iron Castings.
  - .13 ASTM A774 - As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
  - .14 ASTM A778 - Welded, Unannealed Austenitic Stainless Steel Tubular Products.

.15 ASTM B32-08 - Standard Specification for Solder Metal.
.16 ASTM B88 - Seamless Copper Water Tube.
.17 ASTM-B363 - Standard Specification for Seamless and Welded Unalloyed Titanium and Titanium Allow Welding Fittings.
.18 ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
.19 ASTM C283 - Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
.20 ASTM C1007/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
.21 ASTM D792 - Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
.22 ASTM D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
.23 ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
.24 ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.
.25 ASTM D2464 - Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
.26 ASTM D2467 – Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
.27 ASTM D2564 - Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
.28 ASTM D7091 - Standard Practice for Non-Destructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
.29 ASTM E814 (UL 1479) - Standard Test Method for Fire Tests of Penetration Firestop Systems.

.4 American Water Works Association (AWWA):
.1 AWWA-C110 - Ductile Iron and Gray Iron Fittings.
.2 AWWA-C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
.3 AWWA-C151 - American Standard for Ductile Iron Pipe, Centrifugally Cast for Water.
.4 AWWA-C207 - Class D Rings and Blind Flanges.
.5 AWWA-C219 - Bolted, Sleeve Type Couplings for Plain-End Pipe.
.6 AWWA-C800 - Underground Service Line Valves and Fittings.

.5 Canadian Standards Association (CSA)
.1 CSA-B51 - Boiler, Pressure Vessel, and Pressure Piping Code.
.2 CSA-B149.6 - Code for Digester Gas, Landfill Gas, and Biogas Generation and Utilization.

.6 National Sanitation Foundation (NSF):
.1 NSF 61 – Drinking Water System Component – Health Effects.

.7 International Association of Plumbing and Mechanical Officials (IAPMO):
.1 IAPMO PS 117 – Press and Nail Connections.

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted sections, submit the following for all PART 2 – PRODUCTS.
.1 Product Data:
.1 Schedule of all process piping services to be installed in the project schedule to include:
.1 Transport media.
.2 Range of pipe size.

.3 Pipe material.
.4 Joining method.
.5 Pipe grade, classification and applicable standards.
.6 Design pressure.
.7 Test pressure.
.8 Coating type.
.9 Corrosion allowance.

.2 For each piping system include detailed information on pipe fittings, flanges, face rings, bolting and gaskets.

.2 Operation and Maintenance Data:
.1 Operation and Maintenance Manual – refer to Division 1 and Section 15014 for requirements.

.3 Quality Control Submittals:
.1 Submit welder qualification on an annual basis. Welders to be certified for material and position within 12 months of any work being erected.
.2 Pipe fabrication contractor to submit quality control manual for the fabrication, assembly and erection of piping in accordance with CSA-B51 and ASME B31.3.
.3 Pipe coating applicator certification.
.4 Grooved pipe manufacturer's installation inspection reports.
.5 Documentation certifying that suitable solvent is being used for the intended plastic piped service.
.6 Submit chemical tubing sample along with chemical compatibility information.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed equipment/piping accessories.

1.6 QUALITY ASSURANCE

.1 Contractor to review all piping systems and proposed routing prior to installation. The Contractor is integral to the quality control process in accordance with Division 1 and is to identify interferences between equipment, piping and the work of other trades. Plan pipe routing prior to installation of sleeves.

.2 Piping covered in this section is to confirm to ASME B31.3 unless otherwise indicated.

.3 Comply with applicable codes and regulations.

.4 For grooved pipe installations, the manufacturer or its representative shall provide on-site training for the Contractor and shall periodically visit the job site to inspect the installation and submit an inspection report.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

.2 Refer to Section 15030 for Testing Requirements.

1.8 TRAINING:

.1 Refer to Division 1 and Section 15010 for Training Requirements.

1.9 WARRANTY:

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Use various types of pipes, fittings and accessories for process piping as specified herein. Provide other piping requirements as shown on the drawings. Conform to detailed requirements of each product as listed herein.

.2 Alternate pipe materials to those already listed may be considered if demonstrated to be technically equal and there is a cost savings to the Owner. Alternates must be approved by Consultant prior to fabrication or ordering of materials. Refer to Division1.

.3 Design the system to ASME and AWWA standards. Refer to Piping Data Sheets for additional requirements.

2.2 PIPING

.1 Refer to Process Pipe Schedule and the Piping Data Sheets which are included at the end of this specification section.

.2 The drawings indicate the preferred pipe material class for the specific service. The Pipe Schedule references the Pipe Data Sheets to provide detailed material requirements and possible alternate material options.

2.3 ADAPTOR FLANGE

.1 General:
  .1 Rigid adaptor flanges for existing plain end ductile iron, steel or PVC pipe to connect to different pipe materials; also to connect to underground services entering the building.

.2 PVC Pipes:
  .1 Positive end restraint with a series of serrations on inside of flange. Two flange haves to be

bolted together without generating point loads on pipe.

.2 Ductile Iron ASTM A536 flange drilled to ASME B16.5 150 lb. flange. Pressure Rating: 1035 kPa.

.3 Gasket: EPDM with a 50 to 150°C temperature range.

.4 Specified Product: Ford Meter Box Uniflange, Series 900.

.5 Alternate Manufacturers:

.1 Dresser.

.2 Robar.

.3 Smith & Blair.

.3 Steel Pipes:

.1 Ductile Iron ASTM A536 flange drilled to ASME B16.5. Flange fastened to plain end by series heat treated AISI 4140 steel set screws.

.2 Gasket: EPDM with a 50 to 150°C temperature range.

.3 Specified Product: Ford Meter Box Uniflange Series 200.

.4 Alternate Manufacturers:

.1 Dresser.

.2 Robar.

.3 Smith & Blair.

.4 Grooved Pipe:

.1 For use with AWWA grooved end pipe and fittings for mating to ASME B16.1, Class 125 Flanged Components.

.2 Specified Product: Victaulic Style 341.

.3 Alternate Manufacturers:

.1 Approved equal.

2.4 FLEXIBLE FLANGED COUPLING ADAPTOR:

.1 Flexibly adapt plain end pipe to flanged end. Minimum 1030 kPa pressure rating.

.2 Construction:

.1 Flange and Body: ASTM A536 ductile iron, flange drilled to AWWA C207, Class D, 150 lbs.

.2 Fasteners: Passivated 304 stainless steel nuts coated with anti-galling compound.

.3 Coating: Minimum two coats of enamel.

.3 Application: PVC, ductile iron, steel pipe, buried or above-ground application.

.4 Specified Product: Robar 7406.

.5 Alternate Manufacturers:

.1 Dresser

.2 Smith & Blair

.3 Ford Meter Box.

2.5 FLEXIBLE PIPE COUPLINGS (UNRESTRAINED)

.1 Flexible connection of plain end pipes in an unrestrained above ground application.

.2 Coupling to have progressive sealing effect to allow 5 degrees of angular deflection in any direction.

.3 Coupling to provide leakproof axial movement of connected pipes.

.4 Construction:
- .1 Casing: 304 or 316 stainless steel.
- .2 Bolts: Stainless or AISI 4135 steel.
- .3 Bar: Stainless or galvanized steel.
- .4 Sealing Sleeve: EPDM with a temperature range from -20°C to 100°C.

.5 Minimum Pressure Rating: 450 kPa.

.6 Application:
- .1 Water/wastewater.
- .2 Low temperature air (less than 100°C).

.7 Specified Product: Straub Flex Series.

.8 Alternate Manufacturers:

.9 Teekay Couplings.

2.6 FLEXIBLE PIPE COUPLING (UNRESTRAINED BELOW GRADE)

.1 Flexible connection of plain end pipes in an unrestrained below grade application.

.2 Coupling to comply with AWWA C219.

.3 Construction:
- .1 Centre Sleeve: ASTM A536 ductile iron.
- .2 Ending Ring: ASTM A536 ductile iron.
- .3 Gaskets: BUNA-S rubber compound to ASTM D2000.
- .4 Coating: Minimum two coats of enamel.
- .5 Fasteners: To AWWA C111 Standards. 304 stainless steel construction with anti-galling compound.

.4 Pressure Rating: 1035 kPa.

.5 Specified Product: Robar 1406.

.6 Alternate Manufacturers:
- .1 Dresser
- .2 Smith Blair
- .3 Ford Meter Box.

2.7 MECHANICAL TEE FLUSHING DRAIN CONNECTION

.1 Strap-on service saddle used to make a service outlet off of a transmission or distribution line.

.2 Outlet Size: 40 mm.

.3 Construction:
- .1 Saddle Body: ASTM A536 ductile iron with outlet thread to AWWA C-800-05.
- .2 Gasket: BUNA-S rubber compound to ASTM D-2000.
- .3 Strap: Double strap design of 14 gauge 304 stainless steel.
- .4 Fasteners: 304 stainless steel studs complete with stainless steel nuts coated with anti-galling compound.
- .5 Coating: Minimum two coats of red enamel.

.4 Pressure Rating: 1035 kPa.

.5 Specified Product: Robar 2406.

.6 Alternate Manufacturer:
- .1 Dresser
- .2 Smith Blair
- .3 Ford Meter Box.

2.8 MECHANICAL MODULAR SEAL (LINK-SEAL)

.1 The annular space between the installed piping and the sleeve or core shall be completely sealed against a maximum hydrostatic pressure of 135 kPa(g)(20 psig) with a modular mechanical seal consisting of interlocking synthetic rubber links connected by stainless steel bolts and nuts with pressure plates under each end.

.2 Seal type, size, and installation shall be in strict accordance with the manufacturers written recommendations/instructions.

.3 Seal materials to be chemically compatible with all exposed materials

.4 Specified Product: Garlock Link Seal (GPT)

.5 Alternate Manufacturers:
- .1 APS Innerlynx
- .2 Flexicraft
- .3 Approved Alternate.

2.9 HOSES AND DISCHARGE NOZZLE

.1 Provide six (6) dedicated hoses for raw sewage bypass at the lagoon bypass chambers.

.2 Hose to be 15 m long, 150 mm diameter, lay flat type and to be complete with stainless steel Camlock Quick Coupling fittings on both ends. Discharge end to have a fully adjustable stainless steel nozzle.

.3 Temperature Rating: -25° to 75°C.

.4 Pressure Rating: 790 kPa.

.5 Construction:

.1 Tube: high density PVC or Buna-S rubber compound.
.2 Reinforcement: circular woven synthetic cord.
.3 Cover: polyester or PVC.

.6 Specified Product:
.1 JGB Enterprises Eagle Water HD150.

.7 Alternate Manufacturer:
.1 IRP Rubber.
.2 Trelleborg.
.3 Approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION:

.1 Before commencing work, accurately locate all existing pipes and services affected by the work. Consult with Consultant on alterations that may become necessary as a result of the investigation.

.2 Review plans of original construction, available by request from the Consultant, as required to assist in the identification and location of services. Confirm locations by field verification.

.3 Confirm that the site conditions and any relevant existing piping are ready to receive work. Ensure that new piping, fittings and connections are free from defects and are clean prior to installation. Damaged items are to be discarded and replaced.

.4 Determine and confirm that the proposed piping is of the correct size, material and location to connect to its termination point.

.5 Pipe routing and final equipment installation must be coordinated on site with other disciplines prior to fabrication. Refer to Section 15010 with respect to preparation of coordination drawings.

.6 All piping accessories to be installed in strict accordance with the manufacturer's written instructions.

3.2 INSTALLATION

.1 Install piping, joints, fittings and piping accessories as shown on the drawings and in accordance with manufacturer’s written instructions/ recommendations. Notify Engineer when conflicts arise between manufacturer’s recommendations and the Contract Documents. Await direction.

.2 Become informed of installation requirements and dimensions of equipment required to be connected to piping. Where piping is to connect to equipment, preliminary dimensions have been shown that must be verified with the equipment supplier’s shop drawings.

.3 Dimensions, routing and layouts indicated on the drawings are based on specified equipment. Should alternatives be approved in accordance with Section 01340, the Contractor is responsible for all required modifications. Dimensioned drawings to be submitted are subject to Consultant’s approval.

.4 The Contractor is responsible to provide all necessary fittings, reducers, etc. to connect equipment

and accessories to provide a complete piping system.

.5 Install piping to permit equipment access and valve servicing.

.6 Specific joint locations and requirements are shown on the drawings. Provide flanges and regular intervals to industry standards to facilitate system servicing and maintenance.

.7 Install pipes to be free of sags. Minimize the number of bends required and slope pipes where indicated in the Contract Documents.

.8 Use of fabricated fittings will not be accepted where manufactured fittings are available.

.9 Install a pipe joint on both sides of pipes penetrating a slab, wall, ceiling, floor, or foundation.

.10 Route piping so as to:
- .1 allow the application of insulation if required.
- .2 allow a minimum of 25 mm clearances between the outer extremities of pipe runs, including insulation, if required.
- .3 avoid running liquid retaining pipes through electrical rooms.
- .4 not interfere with regular operation of equipment including control panels and respect manufacturer's and code mandated clearances.
- .5 not impede any proposed travel paths, windows or ladder accesses

.11 Maintain indicated fire ratings of walls, ceilings, floors, etc., at pipe penetrations by sealing resulting voids with approved firestop sealant.

.12 Make connections to all equipment and fixtures. Some small diameter pipe has been omitted from drawings for clarity. Connections to fixtures to be no less than 12 mm or connection size, whichever is greater.

.13 Joints:
- .1 Unless otherwise noted, all joints to be restrained.
- .2 Refer to data sheets for additional requirements.
- .3 Denso Paste to be applied to bolt threads.
- .4 Buried bolted joints:
  - .1 Fastener assembly to be 316 stainless steel.
  - .2 Denso paste/tape shall be applied to entire fastener assembly in accordance with manufacturer's instructions.
- .5 Submerged joints:
  - .1 Fastening assembly to be 316 stainless steel.
- .6 Threaded joints:
  - .1 Apply Teflon® tape to male threads/at screwed joints.
  - .2 Ensure sufficient thread length to fully secure fitting but do not exceed three completely exposed threads once fitting is installed.
- .7 Solvent welded joints:
  - .1 Ensure solvent proposed is in conformance to manufacturer's recommendation for use with the piped fluid.
- .8 Flanged joints:
  - .1 Install gasket concentrically on flange.
  - .2 Use flat face flanges when connecting to flat faced ductile iron or cast iron flanges.
- .9 Soldered joints:

.1 Apply ASTM B813-08 flux suitable for use with the piped fluid.
.2 Use ASTM B32 lead-free solder suitable for use with the piped fluid.
.3 Clean away any excess solder after completing joint.
.4 Ensure that any pipe component, equipment, cables, structure, etc., is protected from potential heat damage when constructing joint.

.14 Reducers:
.1 Eccentric Reducers: Install eccentric reducers on pump suction lines so that no air can be trapped and top of both pipes is at same elevation.
.2 Reducers to gradually transition from one diameter to the other. Drastic changes such as provided by a reducing coupling will not be acceptable.

.15 Couplings:
.1 Weld steel tables on both sides of Straub type couplings to prevent coupling creep.

.16 Pipe sleeves:
.1 Required for pipes:
.1 Penetrating concrete liquid retaining structures.
.2 Penetrating below grade building envelope.
.3 As indicated on the drawing.
.2 Refer to Section 15056 for sleeve details.

.17 Drains and Flushing Connection:
.1 Drains required:
.1 At all local low points in a pipe system.
.2 Immediately above isolation valves in vertical installation.
.3 Where indicated on drawings.
.2 Flushing Connections required:
.1 Where indicated on Drawings or wherever required to enable the flushing of the entire system and not more than every 30m.
.2 Other drains to be a minimum of 12 mm diameter complete with end cap.
.3 Caps for all effluent water and process lines to be Camlock Quick Coupling type.
.4 Drains on sludge, centrate, and sewage lines to be a minimum 40mm diameter and to consist of a ball valve and end cap. Refer also to drawing details.

.18 Air Vents:
.1 Required:
.1 At all local high points in a pipe system.
.2 Where indicated on drawings.
.2 Manual air vent to comprise of a 20 mm diameter ball valve complete with end cap.

.19 Primary Control Elements:
.1 Install primary control elements in the piping system where shown or to manufacturer’s written instruction.

.20 At completion of installation process, stainless steel pipes to be cleaned by scrubbing and washing with a pickling solution to remove any iron stains.

3.3 GROUTING

.1 Grouting required:
- .1 Around equipment baseplates and anchors.
- .2 Within equipment bases, where applicable.
- .3 On concrete bases to provide smooth resting surface for pipes.
- .4 Around pipe and sleeve penetrations.
- .5 Where indicated on drawings.

.2 Grouting to be installed in accordance with Division 3.

3.4 PIPE SUPPORT AND ANCHORAGE

.1 To be in accordance with Section 15060.

3.5 TESTING AND REPAIR OF LEAKS

.1 To be in accordance with Section 15030.

3.6 CLEANING AND STERILIZATION

.1 To be in accordance with Section 15083.

.2 Take every precaution to prevent foreign material from entering pipes during installation.

.3 Thoroughly clean and swab interior of each pipe section and fitting before installation.

.4 Flush and sterilize system carrying potable water when installation is complete.

3.7 PROCESS PIPE SCHEDULE

.1 The ‘Process Piping Schedule’ is for convenience only and is not guaranteed to be complete. No claims will be considered on account of discrepancies or omissions in this Schedule. Refer also to drawing notes and pipe data sheets which supersede this schedule.

3.8 HEAT TRACING

.1 Heat tracing to be provided where indicated on drawings.

.2 Heat tracing to be per Division 16.

3.9 SUPPLEMENTS

.1 Process Pipe Schedule.

.2 Pipe Data Sheets:
- .1 304 Stainless Steel ID Pipe, SS-1.
- .2 304 Stainless Steel Schedule Pipe, SS-2.
- .3 PVC Pipe, PVC-1.
- .4 Flexible Plastic Tubing, Flex-1.

END OF SECTION

Application	• Where indicated in the Contract documents. • PVC-1 may be used for the following services: (i) Aluminum Sulfate		
Design Code	ASME B31.3 Design Class: Normal Fluid Service		
Supplemental Design Code	NSF 61 for Potable Water Application		
Design Pressure	1034 kPa (150 psi)		
Design Temperature	22°C (73°F)		
Testing Requirements	Refer to Specification Section 15030		
Item	**Size (mm)**	**Description**	**Notes**
Pipe	All Sizes	PVC Pipe to be ASTM D1784, Type 1, Grade 1 with a Cell Classification of 12454 Schedule 80	
Joining Method	All Sizes	Socket Welded, Flanged or Threaded	(1)
Fittings (Socket Welded)	All Sizes	Socket Welded Fittings Meeting the Requirements of ASTM D2467 Wall Thickness: Schedule 80	
Fittings (Threaded)	All Sizes	Threaded Fittings Meeting the Requirements of ASTM D2464 Wall Thickness: Schedule 80	
Flanges	All Sizes	Molded One (1) Piece Flat Face Design with ASME B16.1 Bolt Pattern	
Fasteners	All Sizes	<u>Standard Environment</u> Bolts: ASTM A193, Grade B7, Carbon Steel Hex Head Bolts Nut: ASTM A194, Grade 2H, Hex Head Nut <u>Corrosive Environment</u> Bolts: ASTM A193, Grade B8 Class1, 304 Stainless Steel Hex Head Bolts, Use with Anti-Seize Compound Nuts: ASTM A194, Grade 8 Hex Head	
Gaskets	All Sizes	1.6 mm Full Face, Class 150 Rubber Gasket with a Shore A Hardness of 70	(2)
Solvent	All Sizes	As recommended by Pipe Manufacturer and Conforming to ASTM D2564 Solvent to be Chemically Compatible with the Pipe Service	(3)

<u>GENERAL NOTES</u>:

- Installation of PVC piping system to be in accordance with manufacturer's written instructions.

<u>SCHEDULE NOTES</u>:

(1) Threaded joints permitted only where required to connect the equipment.
(2) Ensure gasket is suitable for the intended service.
(3) Submit manufacturer's certification confirming that appropriate solvent is being used for the particular service.

Application	• Where indicated in the Contract Documents. • SS-1 may be used for the following services: (i) Raw Sewage (iv) All Process Sludges (ii) Primary and Secondary Effluent (v) Centrate (iii) Process Air (vi) Filtrate		
Design Code	ASME B31.3 Design Class: Normal Fluid Service		
Design Pressure	Pipe Size 0 – 250 mm 1034 kPa (150 psi) Pipe Size 300 – 750 mm 620 kPa (90 psi) Pipe Size 900 – 1500 mm 410 kPa (60 psi)		
Design Temperature	20°C (70°F)		
Testing Requirements	Refer to Section 15030		
Item	**Size (mm)**	**Description**	**Notes**
Pipe	Under 40	Austenitic Stainless Steel ASTM A312 Seamless Grade 304 L Dimensions: ASME B36.19 Wall Thickness: Schedule 40	
	40 - 600	Austenitic Stainless Steel ASTM A778 as Welded Grade 304 L	
	40 - 200	Wall Thickness = 2.0 mm (14 gauge)	
	250 - 300	Wall Thickness = 3.2 mm (11 gauge)	
	350 - 450	Wall Thickness = 3.6 mm (10 gauge)	
	500 - 600	Wall Thickness = 4.7 mm (3/16”)	
	750 - 1500	Wall Thickness = 6.3 mm (1/4”)	
Fittings	Under 40	Threaded to Socket Welded Forged Stainless Steel ASTM A182, Grade 304 L, 6900 kPa Fitting Dimensions: ASME B16.11	(1) (2)
	40 and Larger	Butt Welded Austenitic Stainless Steel ASTM A774, Grade304 L Fittings Wall Thickness: Match that of Adjoining Pipe	
Flanges	Under 40	Class 150, Raised Face, Forged Stainless Steel, ASTM A182, Grade 304 L Threaded or Socket Welded, ASME B16.5	(3)
	40 and Larger	Type 304 L Stainless Steel Pressed Neck or Rolled Angle Type Backing Flange to be Type 304 L Stainless Steel, ASME B16.5, Class 125	
	All Sizes	Flange Thickness to Meet Pressure Rating	
Fasteners	All Sizes	Bolts: ASTM A193 Grade B8, Class1 Stainless Steel Hex Bolts Nut: ASTM A194, Grade 8, Stainless Steel Nut Head	
Gaskets	All Sizes	Ring or Full Face, Non-asbestos. Thickness in accordance with manufacturer recommendations Product: Garlock Blueguard Series.	(4)

GENERAL NOTES:

- Pipes and fittings to be pickled and passivated to ASTM A380.
- Long radius elbows to be used unless indicated otherwise.
- Stub-in style tee connection not permitted.

SCHEDULE NOTES:

(1) Threaded connections only where required by equipment or otherwise indicated. Anti-seize compound required.
(2) Provide olet reinforcements for connection of small diameter piping where standard tees are not commercially available.
(3) Where indicated by equipment, flat face flanges may be used. Flat face flanges are not to be connected with raised face flanges.
(4) Gasket manufacturer to confirm chemical compatibility of gasket with intended pipe service.

Application	• Where indicated in the Contract Documents. • SS-2 may be used for the following services: (i) Raw Sewage (ii) Separated water		
Design Code	ASME B31.3 Design Class	*Normal Fluid Service*	
Design Pressure	1034 kPa (150 psi)		
Design Temperature	20°C (70°F)		
Testing Requirements	Refer to Section 15030		
Item	**Size (mm)**	**Description**	**Notes**
Pipe	All Sizes	Annealed Austenitic Stainless Steel ASTM A312 Seamless Type 304L Dimensions: ASME B36.19 Wall Thickness: Schedule 40s	
Fittings	Under 40	Threaded or Socket Welded forged Stainless Steel ASTM A182 Grade 304L, 6900 kPa Dimensions: ASME B16.11 Wall Thickness: Match that of Adjoining Pipe	(1) (2)
	40 and Larger	Butt Welded Austenitic Stainless Steel ASTM A403 Class WP Grade 304L Fittings Dimensions: ASME B16.9 Wall Thickness: Match that of Adjoining Pipe	
Flanges	Under 40	Class 150, Raised Face, Forged Stainless Steel, ASTM A182 Grade 304L Threaded or Socket Welded, ASME B16.5	(3)
	40 and Larger	Class 150, Raised Face, Forged Stainless Steel, ASTM A182 Grade 304L Butt Welded, ASME B16.5	
Fasteners	All Sizes	Bolts: ASTM A193, Grade B8, Class 1 Stainless Steel Hex Head Bolts Nut: ASTM A194, Grade 8, Stainless Steel Head Nut	
Gaskets	All Sizes	1.6 mm Ring or Full Face, Non-asbestos, Garlock Blueguard Style	(4)

GENERAL NOTES:

- Di-electric separation required when dissimilar materials are connected.
- Pipes and fittings to be pickled and passivated to ASTM A380.
- Long radius elbows to be used unless indicated otherwise.
- Stub-in style tee connection not permitted.

SCHEDULE NOTES:

(1) Threaded connections only where required by equipment or otherwise indicated. Anti-seize compound required.

(2) Provide olet reinforcements for connection of small diameter piping where standard tees are not commercially available.

(3) Where indicated by equipment, flat face flanges may be used. Flat face flanges are not to be connected with raised face flanges.
(4) Gasket manufacturer to confirm chemical compatibility of gasket with intended pipe service.

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This section covers the following:
- .1 Municipal hot, cold and tempered water piping within facilities.
- .2 Effluent water within facilities.
- .3 Separated water within facilities.

.2 Coordinate with Division 2 for all yard water piping.

1.2 REFERENCES

The following is a list of standards that may be utilized in this section. Unless specifically noted otherwise, the reference indicated shall be the latest standard adopted by the regulatory agency as of the tender date.

.1 American Society of Mechanical Engineers (ASME):
- .1 ASME A112.26, Waterhammer Arresters
- .2 ASME B16.5 Flanges and Bolt Dimensions Class 150 to 2500.
- .3 ASME B16.39 Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300.
- .4 ASME B16.42 Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

.2 American Society of Sanitary Engineering's (ASSE):
- .1 ASSE Standard 1001, Performance Requirements for Atmospheric Type Vacuum Breakers.
- .2 ASSE Standard 1003, Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.
- .3 ASSE Standard 1015, Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention.
- .4 ASSE Standard 1018, Performance Requirements for Trap Seal Primer Valves – Potable Water Supplied.
- .5 ASSE Standard 1044, Performance Requirements for Trap Seal Primer Devices – Drainage Types and Electronic Design Types.

.3 ASTM International (ASTM):
- .1 ASTM A 126 Standard Specification for Grey Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B 62, Standard Specification for Composition Bronze or Ounce Metal Castings.

.4 American Water Works Association (AWWA):
- .1 AWWA C501, Standard for Cast-Iron Sluice Gates.
- .2 AWWA C510 Double Check-Valve Backflow Prevention Assembly.
- .3 AWWA C511, Standard for Reduced-Pressure Principle Backflow-Prevention Assembly.
- .4 AWWA C700, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
- .5 AWWA C701, Standard for Cold Water Meters-Turbine Type for Customer Service.
- .6 AWWA C702, Standard for Cold Water Meters-Compound Type.

.5 Canadian Standards Association Group (CSA):
- .1 CSA-B356 Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .2 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.3 CSA-B64.4, Backflow Preventers, Reduced Pressure Principle Type.
.4 CSA-B64.5, Backflow Preventers, Double Check Valve Type (DCVA).
.5 CAN/CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.6 National Research Council Canada (NRC)
.1 National Plumbing Code of Canada (NPC).

.7 National Sanitation Foundation (NSF):
.1 NSF 61-G, Drinking Water System Components
.2 NSF 372, Lead Content Compliance

.8 Plumbing and Drainage Institute (PDI)
.1 PDI-WH201-[R2010], Water Hammer Arresters Standard.

.9 Ontario Building Code:
.1 Part 7.

.10 National Building Code:
.1 Part 7.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Divisions 1 and 15.

.2 Submittals required for all Part 2 products.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed equipment.

1.6 QUALITY ASSURANCE

.1 Conform to latest edition of the following standards in addition to requirements specified herein:
.1 Valve User Guide: MSS SP-92.
.2 Ontario Building Code.
.3 Relevant CSA, ASME, ANSI, MSS Standards.

.2 Published equipment performance ratings for manufactured items to be based on physical tests carried out by the Manufacturer or an independent testing agency in accordance with accepted industry standards, or as specified. Conformance to codes and standards to be confirmed by an independent testing agency at supplier’s cost if proper supporting evidence cannot be provided.

.3 Electrical Equipment not bearing a CSA label requires an ESA field approval.

.4 Where required by Authority having jurisdiction, equipment shall bear a ULC or UL label.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 The Supplier's technical representative shall provide training of plant personnel on site including classroom and hands on instruction for one day. The training shall cover proper operation and maintenance procedures of the tanks.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

1.10 DEFINITIONS

.1 "Separated" water is municipal water downstream of a backflow preventer, i.e. there is some risk of contamination.

PART 2 - PRODUCTS

2.1 PIPING

.1 Separated water pipe 50 mm and smaller: copper, type "K" hard drawn to ASTM B88.

.2 Separated water pipe larger than 50 mm: Type 304L stainless steel (SS-2, Section 15349).

.3 Separated water pipe in process areas: Type 304L stainless steel (SS-2, Section 15349).

2.2 FITTINGS AND JOINTS

.1 Separated water pipe 50 mm and larger; Type 304L stainless steel (SS-2, Section 15349).

2.3 DRAINAGE AND VENT PIPE AND FITTINGS-STAINLESS STEEL

.1 Thin wall Type 304 L SS (SS-1, Section 15349).

.2 Application: Sanitary drainage in the raw sewage wet well and where indicated on drawings. Provide cleanouts per OBC Part 7 and where indicated.

2.4 VALVES GENERAL

.1 Include all valves indicated in the plumbing manual valve schedule, Mechanical and instrumentation drawings (M&IDs), flow diagrams, or as noted in the contract drawings. A valve indicated on any one drawing is to be considered part of the Contract whether indicated on a corresponding plan,

elevation, flow diagram or not. Generally, unless indicated otherwise, valves shown on the Process Instrumentation Drawings (PIDs) and the process P drawings are not covered under this section.

2.5 DIELECTRIC PIPE FITTINGS/UNIONS

.1 Isolate system components from galvanic currents, material of dielectric fittings to suit dissimilar metals in system.

.2 Type: isolating unions for pipe sizes 50 mm and smaller, flanges for pipe sizes 65 mm and larger.

.3 Unions: certify to withstand minimum 600 V on a dry line without flashover. Rate unions at 1725 kPa, conform to ANSI B16.39.

.4 Flange fittings: rate at 1200 kPa, to ANSI B16.42 for iron, to ANSI B16.24 for bronze.

.5 Provide isolating sleeves for flange bolts.

.6 Specified Product:
- .1 Unions: Watts, 3000 Series.
- .2 Flanges: Watts, 3200 Series.

.7 Alternate Manufacturers:
- .1 Zurn
- .2 Mifab

2.6 STRAINERS (SMALLER THAN 75 MM)

.1 Maximum allowable pressure rating of 2750 kPa @ 66°C.

.2 Bronze body, stainless steel Type 304 screen; NPT connections size up to 75 mm. Over 50 mm to have bolted cover.

.3 Type: cleanable Y pattern.

.4 Screens: removable and made from #20 mesh.

.5 Specified Manufacturer: Spirax Sarco; BT/TBT.

.6 Alternate Manufacturers:
- .1 Armstrong
- .2 Crane
- .3 Conbraco
- .4 Mueller.

2.7 BACKWATER VALVES

.1 Provide backwater valve with coated cast iron body with no hub connection.

.2 Valve to have a bolted gasket covered.

.3 Automatic PVC flapper complete with O-ring.

.4 Specified Product: Watts BV-230-R.

.5 Alternate Manufacturer:
- .1 Zurn.
- .2 Mi Fab.

PART 3- INSTALLATION

3.1 MANUFACTURERS INSTRUCTION

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

.2 Installation to be in accordance with OBC

3.2 VALVES

.1 Locate valves for easy access and operation.

3.3 DRAINAGE PIPING INSTALLATION

.1 General
- .1 Install straight, parallel and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes.
- .2 Install flanges or unions to permit removal of equipment without disturbing piping systems.
- .3 Clean ends of pipes, tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.
- .4 Provide traps, trap seal primers and vents for drainage systems per OBC. In areas where automatic trap seal primer valves are indicated, pipe tubing to that location and manifold.
- .5 Connect building sewer services to outside services.
- .6 Connect all fixtures and equipment, unless detailed otherwise. Coordinate with architectural drawings.

.2 Equipment Drainage Piping
- .1 Extend equipment drain piping to discharge into hub or funnel floor drains as indicated on the drawings.

3.4 TESTING

.1 Test water piping in accordance with procedures outlined in Section 15030.

.2 Every pipe in drainage and venting system, except an external leader or fixture outlet pipe to be capable of withstanding without leakage a water test, air test and final test. Carry out tests as required by Section 15030, Testing and authority having jurisdiction.

.3 Every pipe in drainage system to be capable of meeting ball test. Carry out ball test as required by Section 15030, Testing and authority having jurisdiction.

.4 Contractor to carry out installation inspection, integrity (pressure leak) tests and support system inspection of piping system before system is insulated or enclosed. Piping not to be covered until all

inspection and testing deficiencies have been corrected and successful re-testing has been carried out.

.5 Coordinate with authority having jurisdiction the requirement of the authority to witness tests and inspect piping system.

.6 All backflow preventers to be certified on-site by an approved Contractor as meeting requirements of CSA.

3.5 SUPPLEMENTS

.1 Building Services Piping Schedule.

END OF SECTION

SPEC NOTE: Update this table to reflect project specific services

		PIPE MATERIAL	JOINTING METHOD	ATERNATIVE MATERIAL(S)	ALTERNATIVE JOINTING	COMMENTS/REFERENCE SECTIONS
HWR	HEATING WATER RETURN					Section 15701
	50 mm and smaller	Carbon Steel	Threaded; 1034 kPa fittings	Copper	Solder	
	G.T. 50 mm	Carbon Steel	Welded			
HWS	HEATING WATER SUPPLY					Section 15701
	50 mm and smaller	Carbon Steel	Threaded; 1034 kPa fittings	Copper	Solder	
	G.T. 50 mm	Carbon Steel	Welded			
HWR	HOT WATER RETURN (BURIED)	Carrier Pipe: Type L Copper	Per Manuf.			Polyurethane foam insulation and PVC jacketing. Refer to Section 15701
HWS	HOT WATER SUPPLY (BURIED)	Copper Pipe: Type L	Per Manuf.			
SAN	SANITARY DRAIN (GRAVITY)					Section 15400
	Sanitary drains routed through process tankage	St. St.	Welded / Flanged / Victaulic			Provide stainless steel where indicated on drawings (no alternatives)
SW	SEPARATED WATER (MUNICIPAL WATER DOWNSTREAM OF A BFP)					Section 15400 Refer to Municipal Water
	G.T. 50 mm and in process areas	304 L St. St.	Refer to Sections 15349, 15400		Flanged / Victaulic	
	50 mm and smaller	Copper, Type K	Solder/threaded			

		PIPE MATERIAL	JOINTING METHOD	ATERNATIVE MATERIAL(S)	ALTERNATIVE JOINTING	COMMENTS/REFERENCE SECTIONS
VENT	VENT					Material to be as indicated on drawings; per related process fluid, or as approved by Consultant.

Notes:

1. Tables do not preclude individual specification requirements. Refer to specific requirements in specifications.
2. In the event of conflict, tables supercede drawings. Report conflicts to Consultant prior to proceeding.
3. Jointing method at valves and equipment to be dictated by specified connection for valve or equipment or as detailed on the drawing.
4. Refer also to drawings and Section 15060 for specific jointing requirements for flanges, mechanical couplings, etc.
5. Any reference to service water shall be interpreted as separated water. This applies to both drawings and specifications.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This section is for the supply, start-up and commissioning of two (2) natural gas fired hot water boiler all with associated appurtenance as described herein.

.2 The boiler manufacturer (Supplier) is to design, supply and commission a complete and working system. The system is to satisfy the design, operating and construction requirements and limitations to the intent of these specifications.

.3 The Supplier is to be responsible to design, supply and commission a complete system including but not limited to the following:

- .1 Provide hot water heating boilers to fire natural gas supplied by the local utility
- .2 Provide gas trains as specified for each boiler.
- .3 Provide complete and factory tested wiring between the integral boiler controls, valve trains and local boiler control panel(s)
- .4 Design a complete control system including control narratives, hardware and instrumentation, operator interface, safety devices and software in order that the hot water boilers may be operated automatically during all normal operating scenarios. Automatic operation to consist of local automatic operation and remote monitoring as selected by the operator. The remote monitoring will include control signals from a remote PLC (refer to Division 17).
- .5 The Contractor's work is to be limited to unloading, placing of equipment, anchoring, grouting, provision of housekeeping pads, power supply's, interconnecting wiring and piping. The Contractor will assist the manufacturer to commission the equipment.
- .6 The Supplier is responsible to ship materials to site in weather tight containers or packaging to be used for temporary outdoor storage on site if indoor storage in the boiler room is not possible
- .7 The Supplier is to become familiar with the control and instrumentation systems proposed for the Casselman Main SPS and make provisions for appropriate interfaces

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.

- .1 American Boiler Manufacturers Association (ABMA).
- .2 American National Standards Institute (ANSI).
- .3 American Society of Mechanical Engineers (ASME):
  - .1 ASME BPVC.IV: Heating Boilers.
- .4 Canadian Gas Association (CGA).
- .5 CSA Group (CSA):
  - .1 CSA Z432[16] Safeguarding of Machinery.
  - .2 CSA B51: Boiler, Pressure Vessel, and Pressure Piping Code.
  - .3 CSA B149.6: Code for Digester Gas, Landfill Gas, and Biogas Generation and Utilization.
  - .4 CSA B149.1: Natural Gas and Propane Installation Code.
- .6 Electrical Safety Authority (ESA).
- .7 National Electrical Manufacturers Association (NEMA).
- .8 Ontario Building Code (OBC).
- .9 Ontario Energy Act.

.10 Ontario Environmental Protection Act.
.11 Ontario Electrical Safety Code (OESA).
.12 Ontario Hydro Safety Code.
.13 Occupational Safety and Health Administration (OSHA).
.14 Technical Standards and Safety Authority (TSSA).
.15 Underwriters Laboratories of Canada (ULC).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Divisions 1 and 15.

.2 Shop drawing submittals required for the following components
- .1 Boilers & Trim
- .2 Burners
- .3 Gas Trains
- .4 Controls and burner management c/w wiring diagrams.

.3 In addition to the Division 1 and Division 15 submittal requirements submit the following:
- .1 Design Data:
  - .1 Dimensional information, loads, and structural requirements to permit the building systems to be confirmed for the equipment
- .2 Product Data:
  - .1 Manufacturer's catalog information, descriptive literature, specifications, dimensional layouts, and identification of materials of construction
  - .2 Special shipping, storage, protection, and handling instructions.
  - .3 External utility requirements such as power or water for each component
- .3 Operation and Maintenance Data:
  - .1 Operation and Maintenance Manuals in accordance with Division 1.
  - .2 Installation requirements.
  - .3 The Supplier is to submit all operating constraints and design requirements related to the successful commissioning and operation of the hot water boiler package
- .4 Quality Control Data:
  - .1 Suppliers reference list
  - .2 Manufacturer's certificate confirming proper installation.
  - .3 TSSA Field approval for each boiler
  - .4 Factory testing results
  - .5 Guarding drawings

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 Maintenance and Spare parts to be in accordance with Division 1 requirements.

.2 The Contractor shall verify and demonstrate that proper maintenance can be performed on all

installed equipment.

.3 Provide a list of recommended spare parts, including a price list and location of the nearest facility from which all spare parts can be obtained.

.4 As a minimum provide:
- .1 One complete set of items considered as replaceable and/or consumable within twenty-four months of operation based on 24/7 operation.
- .2 One-year supply of all recommended lubricants, including oils and grease based on 24/7 operation.
- .3 Two (2) repair kits for each type and size of valve actuator.
- .4 One set of gaskets for each access opening or panel.

1.6 QUALITY ASSURANCE

.1 Manufacturers of boiler and burners to be regularly engaged in production of equipment of type and size specified. Provide list of references with a minimum of 5-10 years of continuous operating experience.

.2 Boilers and appurtenances to be designed to be in compliance with all applicable municipal, provincial and national codes and standards, including Ontario Technical Standards and Safety Authority requirements

.3 Electrical: CSA and local Electrical Inspection Authority Approval for complete installation. Wiring to Division 16 Standards. ESA field approval, Ontario Hydro Safety Code, Canadian Electrical Code

.4 Equipment to be approved to Canadian standards and must bear markings or labels by the Electrical Safety Authority and TSSA. Refer to Electrical Safety Code.

.5 Boilers to be factory packaged and test fired.

.6 Control systems are to be factory tested and verified through simulated operation.

.7 All operating systems and equipment are to be factory tested. Fuel fired systems to be tested with natural gas.

.8 Advise Consultant two weeks prior to factory tests. Owner and/or Consultant may select to witness factory testing.

.9 Boiler manufacturer's field representative to provide installation, instruction, supervision during start up and commissioning services.

.10 Guarding of moving parts: To be in accordance with CSA Z-432 and OSHA requirements. All drawings including guarding and safety related electrical and controls must be stamped by a professional Engineer licensed in the Province of Ontario unless the manufacturer provides a letter clearly listing the most recent and applicable design standards and stating that the equipment supplied meets these standards in order that the Ministry of Labour exemption requirements for a Prestart Review are met.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements.

.2 Start-up and commissioning to be completed by factory trained service representative from regional service office.

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 Training required for the boilers and associated appurtenances.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

.2 Primary Heat Exchanger to have 10 year warranty.

.3 Secondary Heat Exchanger to have 5 year warranty.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Heating system shall be designed for continuous automatic operation 24 hours per day/365 days per year. Actual operation may be intermittent.

.2 Following start-up and initial supervision, the Hot Water Boiler System to be capable of meeting the performance requirements through automatic unattended operation.

.3 Boiler to be complete and ready for mounting on floor or concrete pad.

2.2 BOILER REQUIREMENTS

.1 Conform to requirements of regulations of Province of Ontario, plus the latest editions of the following:
- .1 ASME: Boiler and Pressure Vessel Code Section IV, Rules for Construction of Heating Boilers.
- .2 CSA: B51, Canadian Interprovincial Boiler Code.
- .3 Ontario Hydro Safety Code.
- .4 Canadian Electrical Code.
- .5 Piping to ANSI Standards, Ontario Energy Act for Gas.
- .6 Stack: Ontario Environment Acts.
- .7 Gas Piping to conform to Canadian Gas Association Appliance Installation.
- .8 CSA B149.6 – Latest Edition, Code for Digester Gas and Landfill Gas Installation.
- .9 TSSA Fuel Safety Branch Safety Requirement.
- .10 Canadian Gas Association - B149.1. Latest Edition, Natural Gas and Propane Installation Code.
- .11 TSSA Boiler and Field Approval Process.

.2 Provide Canadian registration number CSA B51 of the unit attesting to unit meeting the requirements of the Chief Boiler Inspector of Ontario.

.3 All electrical equipment wiring to conform to ULC requirements and agencies having jurisdiction. Electrical Safety Authority ESA for Ontario is required for the burner control panel(s) and packaged boiler prior to delivery of the boilers to job site. Use oil, heat and moisture resistant wire throughout.

.4 Unit to bear seal attesting its meeting the standard set individually by the American Boiler Manufacturers Association and Canadian Gas Association, International Approval Services for natural gas fuel and unit to have affixed a label meeting the TSSA Field Approval process.

.5 Contractor to apply for all approval processes with TSSA, including Boiler Field Approval Process.

.6 All drawings, including controls, etc. must be approved by the Consultant.

2.3 BOILER CAPACITY

.1 Required Boiler capacities as indicted below:
- .1 Heating Output: 40 kW
- .2 Gas Pressure: 200mmWC

2.4 BOILER DESIGN

.1 Boiler heat exchanger to be cast aluminum mono block.

.2 The combustion chamber to be sealed and located at the top of the mono block casting, and to be of counterflow design.

.3 Boiler to be supplied complete with a gas valve designed with negative pressure regulation, down to inlet gas pressures of 4” W.C., and to shut off if pressure exceed 13” W.C.

.4 Burner shall be premix combustion type with a variable speed blower capable of achieving 5:1 turndown ratio for the heating output.

.5 Boiler(s) must be capable of using outside air piped directly to boiler (direct vent), or inside boiler room air for combustion (direct exhaust).

.6 Boiler shall be floor mounted.

2.5 BOILER HOT WATER TRIM

.1 High limit temperature control (190 degrees F maximum allowable boiler water temperature).

.2 Combination pressure-temperature gauge. Gauge dial clearly marked and easy to read.

.3 ASME certified pressure relief valve, set to relieve at 30 PSIG.

.4 Flue gas, outlet water temperature, and return water temperature sensors.

.5 Low water protection (LWCO Kit).

.6 Taco 0014 Boiler Circulator

.7 PVC Concentric Vent Kit with Sidewall Termination Cap.

.8 Condensate Neutralizer Kit.

2.6 BOILER OPERATION

.1 Approved, packaged system designed to burn fuel safely and quietly at optimum efficiency as standard to manufacturer. Unit to have TSSA Fuel Safety/Field Approval.

.2 Fuel-air ratios to be maintained automatically for optimum firing efficiency at all times.

.3 Burners to be forced draft type with ignition from interrupted spark ignited nature gas pilots, pilot pressure regulator, pilot solenoid valve, pilot gas shutoff valve.

.4 Prewired, factory assembled electronic controls in front of control cabinet with flame scanner for fuel, programming control, relays and switches.

2.7 BURNER & PIPING

.1 Natural gas piping to be carbon steel in accordance with CSA B149.1-20

.2 Burner operation to be full modulation with 5:1 turndown ratio on natural gas.

.3 Combustion air to be supplied by blower.

2.8 BOILER CONTROL PANEL

.1 Provide boiler control panel for each boiler complete with control wiring diagram with identification of all components. Controller to have 3.5” LCD display. Boiler to be configured to operate the two boilers in duty/standby operation with automatic switchover on boiler failure. Boilers to have ignition control, high limit and modulating temperature control. Boiler to have output alarm signal for signaling to operators.

2.9 SPECIFIED PRODUCT(S):

.1 Natural Gas Boiler: Weil-McLain Ultra Boiler.

2.10 ALTERNATE MANUFACTURER:

.1 Clever Brooks.
.2 Volcano.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Boilers and associated accessories are to be installed as per manufacturer’s written instructions.

.2 Paint all natural gas piping and gas vent piping, colour to meet requirement of local authority having jurisdiction.

.3 Verify boiler on delivery at site check for structural damage and combustion chamber refractory, verify electrical characteristics, unit capacity and options are as specified.

.4 Ensure that piping tested for leaks, cleaned and purged with dry air.

.5 Check flame safeguard control.

.6 Lock up and seal gas valve prior to operational start up testing.

.7 Connect piping, breeching and coordinate wiring required.

.8 Weld all breeching.

.9 Install all gas vent piping to regulator, solenoid vent valves and as required by Code.

.10 Test all gas piping to Section 15030.

.11 Provide gas piping with full-size dirt leg with drain and cap before each burner gas train assembly.

3.2 FACTORY ACCEPTANCE

.1 The Supplier will assemble the entire system including, but not limited to:
- .1 Hot water boiler and burner.
- .2 Gas trains.
- .3 Controls.
- .4 Accessories.

.2 The Supplier will interconnect all components to resemble the proposed installation.

.3 Factory tests will consist of, but not limited to:
- .1 Simulation of control system and logic using simulated signals for remote automatic control.
- .2 Verify vibration, noise, air emissions, and control functions.
- .3 Complete functional verification of safety devices, interlocks, and instrumentation and control panel.
- .4 Wiring and communication between local boiler controls, valve trains and control panel.

.4 Factory acceptance test reports to be sent to the Consultant for review upon completion of the tests.

.5 The Hot Water Boiler System will be shipped to the site once the Consultant has reviewed the Factor Acceptance Test Reports verifying the boiler is operating as required and the General Contractor has agreed to receive the equipment.

.6 The Supplier will provide all required instrumentation required to complete factory acceptance tests including calibration certificates by an independent third party. Testing to be to industry standards and/or as specified in this RFP.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Provide pumps for hydronic heating system.

.2 Alternate manufacturer to provide pump with similar performance through the entire pump operating range.

.3 Refer to pump schedule for scope and application.

1.2 QUALITY ASSURANCE

.1 The design and performance of the system(s) is based on the specific performance characteristics of the specified pump and impeller. Alternate pumps are to provide a similar performance characteristic. The sole judge of the acceptability of alternate pumps or impellers will be the Consultant.

PART 2 - PRODUCTS

2.1 VERTICAL INLINE CENTRIFUGAL PUMPS (TYPE 2)

.1 Provide horizontal inline close coupled single stage end suction centrifugal pumps for the following systems in accordance with scheduled performance criteria:
  .1 Primary hydronic loop circulation pumps.

.2 Construction:
  .1 Class 30 cast iron casing, enclosed cast bronze impeller, secured to shaft by means of key, washer and stainless steel cap screw. Balance impeller to ANSI/HI Grade G6.3.
  .2 Pump internals to be capable of being serviced without disturbing piping connections.
  .3 Pump shaft to be stainless steel.
  .4 Motor bearings to be permanently lubricated ball bearings.
  .5 Pump to have inernally-flushed mechanical seal assembly.
  .6 Impeller to be of brass construction and hydraulically and dynamically balanced.
  .7 Volute to be cast iron. And include gauge ports and nozzles.
  .8 Rated for 1200 kPa working pressure, ANSI flanges, suction and discharge gauge tappings.
  .9 Motor to be NEMA rated. Starters by Division 16.
  .10 Run extended alloy steel motor shaft in two heavy duty deep groove ball bearings.
  .11 Provide mechanical seal internally flushed, ceramic seal seat, carbon seal ring, suitable for continuous operation at 110°C.

.3 Performance: as scheduled.

.4 Guarding: guarding to meet OSHA requirements.

.5 Each pump is to be factory tested.

.6 Specified Manufacturer: Bell & Gossett Series e90.

.7 Alternate Manufacturers:
- .1 Grundfos
- .2 Armstrong
- .3 Paco
- .4 Taco.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install pumps in accordance with manufacturer's requirements.

.2 Provide mounting supports on piping, pump intake and discharge for inline pumps.

.3 Test system to verify capacity, sequence of operation and flow.

.4 Capacities to be verified using non-intrusive ultrasonic flow meter. Coordinate with Balancing Contractor.

.5 Certify system performance and installation as per Section 15010.

.6 Grout base plates and frames of base mounted pumps.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This specification covers ductless split system air conditioners. The capacities are as scheduled or as indicated herein.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
- .1 American Society of Mechanical Engineers (ASME):
  - .1 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- .2 American Society for Testing and Materials (ASTM):
  - .1 ASTM A48: Standard Specification for Gray Iron Castings.
  - .2 ASTM B584:-Standard Specification for Copper Alloy Sand Castings for General Application
  - .3 ASTM E165: Standard Practice for Liquid Penetrant Examination for General Industry.
- .3 American Iron and Steel Institute (AISI).
- .4 Hydraulic Institute Standards:
  - .1 HI 11.6: Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Test.
- .5 International Organization for Standardization (ISO):
  - .1 ISO 9906: Rotodynamic Pumps – Hydraulic Performance Acceptance Test.
- .6 National Electrical Manufacturer's Association (NEMA).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted section, submit the following for all PART 2 – PRODUCTS.

.3 Product Data:
- .1 Relevant information to confirm that the specifications have been met. Identify all deviations.
- .2 Identify construction materials for all major components.
- .3 Relevant data illustrating full range of operation including fan curves, if applicable.
- .4 Written sequence of operation
- .5 Wiring diagrams
- .6 Electrical motor information and specification.
- .7 Anchoring requirements.

.4 Operation and Maintenance Data:
- .1 Operation and Maintenance Manuals. Refer to Division 1 and Division 15, section 15014 for requirements.
- .2 Manufacturer's installation requirements.

.5 Quality Control Data:
- .1 Manufacturer's certificate confirming proper installation.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed units.

1.6 QUALITY ASSURANCE

.1 Equipment manufacturer to provide a written certification stating that the units(s) has(have) been installed to their standards.

.2 Incremental unit and associated equipment to be approved to Canadian standards and must bear markings or labels by the Electrical Safety Authority. Refer to the Electrical Safety Code.

.3 Incremental unit manufacturer to have proven established network of service centres in Eastern Ontario.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 Training required for all incremental units.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

.2 In addition to the Division 1 requirements provide a 5 year parts warranty and a 7 year compressor warranty

PART 2 - PRODUCTS

2.1 INCREMENTAL UNITS

.1 The air conditioning system shall be a split system consisting of evaporator section with wired control and outdoor condensing unit.

.2 Units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

.3 The units shall be rated in accordance with ARI Standard 210 and bear the ARI label.

.4 A full charge of R410-A for 30 m of refrigerant tubing shall be provided in the condensing unit. A dry air holding charge shall be provided in the evaporator.

.5 System efficiency shall meet or exceed 13.6 SEER.

2.2 INDOOR UNIT

.1 The indoor unit shall be factory assembled, wired and run tested including wiring, piping, control circuit board and fan motor. The unit in conjunction with the remote controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes will be charged with dry air instead of R410-A before shipment from the factory.

.2 The casing shall have a white finish.

.3 Provide with drain pan and integral P-trap for condensate collection.

.4 Provide condensate drain pump as indicated scheduled or indicted herein.

.5 Fan:

- .1 The evaporator fan shall be two speed, double inlet, forward curve fans driven by a single motor.
- .2 The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
- .3 A motorized air sweep flow louver shall provide an automatic change in airflow by directing the air from side to side for uniform air distribution.
- .4 Return air shall be filtered by means of an easily removable washable filter.
- .5 The evaporator coil shall be of non-ferrous construction with smooth plate fins on copper tubing.

.6 Power shall be 115 volts, 1 phase, 60 Hertz. Powered by condenser (outdoor unit).

.7 Control:

- .1 The controller shall consist of an ON/OFF switch, Cool/Dry-Fan selector, Thermostat setting, Timer Mode, High-Low fan speed, Auto Vane selector, Test Run switching and Check Mode switching.
- .2 The control system shall consist of two (2) microprocessors interconnected by a single non-polar two wire cable.
- .3 Manufacturer shall provide two (2) conductor 18 Ga. Stranded wire for connection to remote controller.
- .4 The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.
- .5 The controller shall have the capability of controlling up to a maximum of fifty (50) systems at a maximum developed control cable distance of 1,650 feet.
- .6 The system shall include self-diagnostics including total hours of compressor run time.
- .7 The microprocessor within the wall mounted remote controller shall provide automatic cooling, display set point and room temperature, 24 hour ON/OFF timer so that automatic operation function display, check mode for memory of most recent problem.

2.3 OUTDOOR UNIT

.1 Equipped with a circuit board that interfaces to the PC indoor unit and perform all functions necessary for operation. The unit must have a powder coated finish, factory assembled, piped and

wired. The casing shall be fabricated of galvanized steel, finished with a powder coated baked enamel.

.2 Fan:

.1 Furnished with direct drive propeller type fans, permanently lubricated bearings, horizontal or vertical discharge airflow.

.3 Coil:

.1 The condenser coil shall be of non-ferrous construction with lanced or corrugated plate fins on copper tubing.

.2 Refrigerant flow from the condenser shall be controlled by means of a metering orifice.

.4 Compressor:

.1 Rotary compressor, crankcase heater, internal thermal overload, high pressure safety switch, mounted to avoid the transmission of vibration, capable of operating at -18°C ambient temperature without additional low ambient controls.

.2 Provide factory installed low-ambient kit for operation at ambient temperatures down to -40°C as indicated scheduled or noted herein.

.5 Electrical:

.1 208 volts, 1 phase, 60 Hertz.

.2 The outdoor unit shall be controlled by the microprocessor located in the indoor unit.

2.4 CAPACITY

.1

Unit tag	Capacity		Ultra-low Ambient Kit (Y/N)	Condensate Pump (Y/N)	Evaporator configuation
	Cooling(kW)	Heating(kW)			
AC-91821/ CND-91821	10.5	N/A	Y	Y	Exposed Ceiling Suspended

2.5 SPECIFIED PRODUCT

.1 Specified Product: Mitsubishi Mr. Slim P-Series

2.6 ALTERNATE MANUFACTURERS

.1 Approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Confirm exact installation location on site with Consultant.

.2 Coordinate equipment installation to leave an operating system. Install in accordance with

manufacturer's instructions.

.3 Submit written documentation from the equipment manufacturer confirming proper installation.

.4 Complete refrigerant piping. Install and support to avoid interference with other services, and to protect from damage. Confirm proposed routing with Consultant. Size refrigerant piping according to manufacturer’s instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This specification covers general ventilation including louvres, ductwork, and accessories.

.2 Refer to the drawings to establish duct quantity and material requirements as louvre sizes and quantities.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.

- .1 American Society for Testing and Materials (ASTM):
  - .1 ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .2 ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, Strip.
  - .3 ASTM B209/B209M: Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  - .4 ASTM A480/A480M: Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
  - .5 ASTM A635/A635M: Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy With Improved Formability, General Requirements for.
  - .6 ASTM A653/A653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
  - .7 ASTM 924/924M: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - .8 ASTM A90/A90M: Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
  - .9 ASTM D2996: Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
  - .10 ASTM D3982: Standard Specification for Contract Molded “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Ducts.
  - .11 ASTM D1784: Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
  - .12 ASTM A700: Standard Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment.
- .2 American Welding Society (AWS).
- .3 Factory Mutual Laboratories (FM Approvals):
  - .1 FM 4910: Cleanroom Materials Flammability Test Protocol.
  - .2 FM 4922: Fume Exhaust Duct or Fume and Smoke Exhaust Ducts.
- .4 National Bureau of Standards (NBS):
  - .1 NBS PS 15-69: Custom Contact-Molded Reinforced Polyester Chemical-Resistant Process Equipment.
- .5 National Fire Protection Association (NFPA):
  - .1 NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B: Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  - .3 NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials.
- .6 Sheet Metal and Air Conditioning Contractors National Association (SMANCA).
- .7 Underwriters’ Laboratories (UL):
  - .1 UL-181: Factory-Made Air Ducts and Air Connectors.

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted section, submit the following for all PART 2 – PRODUCTS.

- .1 Product Data:
  - .1 Relevant information to confirm that the specifications have been met. Identify all deviations.
  - .2 Duct engineering description, performance data, construction details; duct thickness, longitudinal seams, lateral joints, reinforcement details & spacing, connections, hanger and support system, gaskets, and sealants
  - .3 FRP Resin details

- .2 Operation and Maintenance Data:
  - .1 Operation and Maintenance Manuals. Refer to Division 1 and Division 15, section 15014 for requirements.
  - .2 Manufacturer's installation requirements.

- .3 Quality Control Data:
  - .1 Structural Engineer review and approval documentation confirming the design of supports, anchors and restraints prior to submission.
  - .2 Manufacturer's certified testing results.
  - .3 Manufacturer's certificate confirming proper installation.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed accessories.

1.6 QUALITY ASSURANCE

.1 Ventilation equipment to meet CSA Z299.4 Quality Inspection Program

.2 Ductwork and supports to be to SMACNA and ASHRAE Standards.

.3 NFPA Compliance: NFPA 90A and NFPA 90B

.4 Only firms who regularly engage in manufacture of ductwork products of types, materials, and sizes as specified herein, whose products have been satisfactorily used in similar service for not less than 5 years shall be permitted to submit.

.5 Supports, anchors and restraints to conform to and be coordinated with the structural requirements of the Ontario Building Code and the requirements of the Structural Engineer responsible for the design of structural support systems for mechanical systems and equipment.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements

1.8 TRAINING

.1 Not Required

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 GENERAL DUCT REQUIREMENTS

.1 Application: Where indicated on the drawings

.2 Where no specific ductwork materials are indicated in Specifications or on Drawings, galvanized steel sheet metal shall be basis of Contract

.3 Specified components of the ductwork system, including adhesives, shall have fire hazard rating not to exceed 25 for flame spread and 50 for smoke developed, as per test conducted in accordance with ASTM E84 and NFPA 255 methods.

.4 Branch duct connections to round duct mains shall be made using factory fabricated fittings

.5 Reinforcement material: Unless otherwise indicated, provide reinforcements of same material as ductwork

2.2 GALVANIZED STEEL DUCTWORK

.1 Application: Where indicated on the drawings

.2 Duct work and fittings Design Criteria:
- .1 Static pressure range: less than 2500 Pa.
- .2 Maximum Velocity 10 m/s.
- .3 Duct Classification: Class 5 (Corrosive Fumes).

.3 Steel specification:
- .1 Ducts to be galvanized steel, to SMACNA standards. Minimum duct thickness to be 24 Ga. or per SMACNA Guidelines, whichever is greater
- .2 Steel to be in accordance with ASTMA653/A653M and ASTM A924/A924M ASTM A653 G90 zinc coating. Coating designation in accordance with Test Method A, ASTM A90/A90M. and ASTM A924/A924M.
- .3 Provide sheet metal packaged and marked as specified in ASTM A700

.4 Joints: to SMACNA (manufactured duct joint).
- .1 Specified Product: Ductmate 25/35/45.

.5 Support: duct support to SMACNA. Construction Materials: Supporting devices including, but not limited to, angles used for support and bracing, baseplates, rods, hangers, straps, screws, bolts shall be as follows:
- .1 Indoors: Carbon steel, zinc electroplated.

.2 Outdoors: Carbon steel, hot-dipped galvanized after fabrication.

.6 Turns in ductwork:
- .1 Standard radius (or short radius with single thickness turning vanes). Where a specific fitting is indicated on drawings, provide alternate only following Consultant's approval.
- .2 Square Elbows: up to 400 mm to be single thickness.
- .3 Square Elbows: over 400 mm to be double thickness.

.7 Duct sealing classifications to be in accordance with SMACNA and the following:
- .1 Seal Class A: seal all transverse joints, longitudinal seams and duct wall penetrations. ASHRAE leakage Class 1.5, 1% of airflow at .5 kPa.
- .2 Seal Class B: seal all transverse joints and longitudinal seams. ASHRAE leakage Class 3, 2.4% of airflow at .5 kPa.
- .3 Seal Class C: seal all transverse joints. ASHRAE leakage Class 6, 4.7% of airflow at .5 kPa

.8 Leakage less than 1% of average airflow.

.9 Fasteners
- .1 Rivets, bolts, or sheet metal screws
- .2 Sheet metal screws shall be hex washer head (HWH) TEKS® self-drilling type, formed from heat-treated carbon steel with zinc electroplated finish

.10 Dampers: Refer to 15850

2.3 FLEXIBLE CONNECTIONS

.1 Neoprene coated glass fabric, minimum weight 0.68 kg/m² field or factory fabricated, not more than 150 mm long between 24 Ga. metal parts and installed with just sufficient slack to prevent vibration transmission at 112°C rating, self-extinguishing fabric.

.2 Provide flexible connection at inlet and outlet of each in-line fan and air handling unit.

.3 Comply with NFPA 90A and 90B requirements.

.4 Airtight and waterproof construction. Flame-retarded or non-combustible fabrics, coatings, and adhesives complying with UL 181, Class 1

.5 Specified Manufacturers:
- .1 DuroDyne.
- .2 DynAir.

2.4 SEALANTS AND TAPES

.1 Provide sealants and tapes to suit application.

.2 Sealant: Water based indoor/outdoor sealant, permanently flexible, not to support fungal growth, non-flammable.

.3 Service temperature -7°C to 93°C; ULC listed for 0 flame speed and smoke development.

.4 Specified Manufacturers:
  .1 Dyn/Air
  .2 Childers.

2.5 LOUVRES

.1 Construction: all welded with joints ground flush and smooth.

.2 Blade: stormproof pattern, extruded aluminum with centre watershed in blade. Material: 6063-T5 alloy, 2 mm with reinforcing bosses and maximum blade length of 1500 mm.

.3 Frame, head, sill and jamb: one piece extruded aluminum minimum 3 mm 6063-T5 alloy with approved caulking slot, integral to unit, U-channel mounting, 100 mm 150 mm or 200 mm depth.

.4 Mullions: at 1500 mm maximum centres.

.5 Fastenings: all stainless steel SA-194-8F with SA-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, stainless steel washer and aluminum body. Heat treated, quenched in water and annealed.

.6 Screen: 12 mm mesh, 2 mm diameter (No. 14 AWG) aluminum birdscreen on inside face of louvres in formed U-frame.

.7 Finish: factory applied, baked enamel. Submit colour chip for final colour selection by Consultant.

.8 Louvre Sizes: as indicated on drawings.

.9 Specified Manufacturer: Tamco Model 3600 (Intake), Model 4600 (Exhaust).

.10 Specified Manufacturers:
  .1 Nailor.
  .2 Construction Specialties.
  .3 Alternate louvers to provide no less than the free area available with the specified manufacturer for each size of louver

2.6 LOUVRED PENTHOUSE

.1 Application: Where indicated on the drawings.

.2 Construct factory build louvred penthouse using 100 mm deep louvers. 12 Ga. Aluminum louver construction, 2 mm thick, 12 Ga. Aluminum frame and blades. Welded construction, bird screen; 55% free area. Positive locking corners; insulated roof designed for snow and wind loading per OBC.

.3 Refer to drawings for dimensions and configuration.

.4 Duranar finish; custom colour to be confirmed.

.5 Specified Manufacturer: Airolite.

.6 Alternate Manufacturer: Construction Specialties.

2.7 DUCT ACCESS DOORS

.1 Doors: galvanized mounting frame of thickness equal to duct, provide with fastening devices to give tight closure on neoprene gasket securely formed onto door frame. Door for insulated duct to be double panel construction with 13 mm rigid insulation material between metal panels.

.2 Specified Manufacturer: Nailor.

.3 Alternate Manufacturers:
- .1 Ruskin
- .2 Greenheck
- .3 Approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installations to conform strictly to all local and Provincial Code requirements.

.2 Conform all work to standards of good practice recommended by SMACNA and the latest ASHRAE Guide and Data Book.

.3 Installation of rigid ductwork and flexible ductwork in accordance with SMACNA Manual, NFPA 90A, and NFPA 90B

.4 Install ductwork in accordance with manufacturer's instructions and recommended adhesives, cement, sealant, and insulation accessories.

3.2 FLEXIBLE DUCT JOINTS

.1 Connect flexible ducts to other ductwork or equipment with triple-lock joints. Secure joints by at least three wraps of pressure sensitive, vapour seal adhesive tape, or with mastic duct sealant and sheet metal screws or stainless steel band with cadmium-plated hex screw to tighten band with worm-gear action

.2 Length of flexible ductwork not to exceed 1.5 m.

.3 Ducts to be continuous with no intermediate joints.

3.3 HANGING AND SUPPORTING SYSTEM

.1 Provide support, anchorage and restraint of ductwork designed and constructed in accordance with the latest edition of the following standards:
- .1 The Ontario Building Code
- .2 ASHRAE Applications, Seismic Restraint Design
- .3 SMACNA Duct Construction Standards.

.2 Provide certification of the design of the ductwork support, anchorage and restraint system by a Structural Engineer licensed in the Province of Ontario. The construction of the support, anchorage and restraint system is to be reviewed and certified by the Structural Engineer.

.3 Coordinate ductwork support/anchorage/restraint systems with the requirements and constraints of the structure, vibration isolation systems and the support, anchorage and restraint systems for electrical and architectural components of the building

.4 Support flexible ducts by hangers every 1 m. Support method to prevent duct damage by vibration or other motion. Do not lay ducts across lighting fixtures or other hot surfaces.

3.4 CASINGS AND PLENUMS

.1 At floor line and at other points where casings join masonry construction, rivet casing on maximum 300 mm centres to 38 mm x 38 mm x 3.2 mm angle. Secure angles to masonry with expansion or toggle bolts on 300 mm centres and caulk airtight to masonry.

3.5 LOUVRES

.1 Check openings to ensure that dimensions conform to drawings.

.2 Ensure that louvre is compatible with wall construction prior to ordering louvre. Check that openings are free of irregularities which interfere with installation.

.3 Place louvre in wall opening and fasten to building structure.

.4 Follow procedures in manufacturer's recommended installation instructions.

.5 Prior to ductwork connection, secure birdscreen and frame to louvre interior.

.6 Repair damage to louvres to match original or replace unit.

.7 Clean louvres and screens of construction dirt, leaves and other matter.

3.6 OBSTRUCTIONS

.1 No pipes, wire, structural member or other obstruction will be allowed in ductwork.

3.7 TESTING

.1 Test high pressure risers and mains by means of a small pressure blower, a calibrated metering on face, and a U-gauge manometer to measure the test static pressure developed in the ductwork.

.2 Carry out leak tests at test pressure 500 Pa above system design pressure and repeat until leakage is proven at less than the following:

.1 Seal Class A: 1% of airflow.

.3 Test VAV systems at design pressure which could exist at maximum flow rates.

END OF SECTION

CASSELMAN MAIN SPS UPGRADE
CASSELMAN, ON
JLR No.: 16953-134

FAN SCHEDULE

SECTION: 15821

SHEET 1 OF 1

UNIT I.D.	DESCRIPTION	TYPE	FAN				SOUND @ INLET	ELECTRICAL			FIELD WORK				COMMENTS
			AIRFLOW L/s	EXT. S.P. Pa	DRIVE TYPE	RPM	LwA	POWER HP	VOLTS V	PH	SUPPLIED BY	INSTALLED BY	WIRED BY	COMM. BY	
SF 91821	ELECTRICAL ROOM SUPPLY FAN	1	47	250	BELT	1712	73	0.25	120	1	M	M	E	G	PROVIDE EC MOTOR C/W SPEED CONTROLLER AT FAN.
EF 91822	PUMP ROOM EXHAUST FAN	1	463	125	BELT	1712	73	0.5	120	1	M	M	E	G	PROVIDE EC MOTOR C/W SPEED CONTROLLER AT FAN.

FIELD WORK NOTATION

M = MECHANICAL CONTRACTOR
E = ELECTRICAL CONTRACTOR
G = GENERAL CONTRACTOR
EX = EXISTING EQUIPMENT

PLOT DATE: December 4, 2024 3:50:07 PM

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This specification covers the supply, installation, and commissioning of building mechanical fans and associated accessories.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
- .1 Air Movement and Control Association International (AMCA)
  - .1 AMCA Standard 99: Standards Handbook
  - .2 AMCA Standard 300: Reverberant Room Methods for Sound Testing of Fans
  - .3 AMCA Standard 301-14: Methods of Calculating Fan Sound Ratings from Laboratory Test Data
  - .4 AMCA Standard 500-D: Laboratory Methods of Testing Dampers for Rating
- .2 National Fire Protection Association (NFPA):
  - .1 NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems.
- .3 Canadian Standards Association: (CSA).
  - .1 CSA Z432 – Safeguarding of Machinery.
- .4 American Bearing Manufacturers Association (ABMA)
- .5 Sheet Metal and Air Conditioning Contractors National Association (SMANCA).
- .6 National Electrical Manufacturer's Association (NEMA).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted section, submit the following for all PART 2 – PRODUCTS.

.3 Product Data:
- .1 Relevant information to confirm that the specifications have been met. Identify all deviations.
- .2 Identify construction materials for all fan components.
- .3 Provide fan curves, with related performance data, for all fans based on design conditions scheduled. Performance data to include fan curves at performance point as well as at 100 rpm increments through full operating range.
- .4 Electrical motor information and specification.
- .5 Loadings imparted to the fan base.
- .6 Permissible range of vibration.
- .7 Factory finishing details.
- .8 Noise data
- .9 Anchoring requirements.

.4 Operation and Maintenance Data:
- .1 Operation and Maintenance Manuals. Refer to Division 1 and Division 15, section 15014 for requirements.
- .2 Manufacturer's installation requirements.

.5 Quality Control Data:
- .1 Manufacturer's certified testing results.

.2 Manufacturer's certificate confirming proper installation.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed fan.

.2 For each fan model and size, provide the following spare parts:
.1 One(1) set of drive belts per belt driven fan.

1.6 QUALITY ASSURANCE

.1 Design of systems is based on the specified and its inherent performance through the full range of the performance curve. Fan selection has also taken into consideration fan performance at different operating speeds. Alternate fan sections to provide a similar performance to the specified unit. The Consultant will be the sole judge of equivalency.

.2 Pwl ratings: comply with AMCA 301 tested to AMCA 300. Unit to bear AMCA certified sound rating seal.

.3 Balancing: statically and dynamically balance fans, construct in conformity with AMCA Bulletin 99.

.4 Ratings: base on tests performed in accordance with AMCA Bulletins 210 and ASHRAE 51, unit to bear AMCA certified rating seal.

.5 Selection: fans to be standard products, selected from published literature of manufacturer.

.6 Finish: factory coat over primer on all parts, colour standard to manufacturer. Paint before assembly and repaint after. Colour to be approved by Consultant.

.7 Fans and associated equipment to be approved to Canadian standards and must bear markings or labels by the Electrical Safety Authority (ESA). Refer to the Electrical Safety Code.

.8 Electrical Equipment not bearing a CSA label requires an ESA field approval

.9 Guarding to meet OSHA and CSA Z432 requirements.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 Training required for all Part 2 equipment

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

.1 Provide fans with the indicated for flow rate, total pressure, total static pressure (TSP), shutoff pressure, rpm, kW, tip speed, size and pwl,

.2 Belt drives: provide replacement sheave to permit approximately 30% change in speed up to maximum kW.

2.2 PROTECTIVE COATINGS

.1 Epoxy coating (2 mil thickness - dry) required for fans exposed to corrosive environment and where indicated on the fan schedule.

.2 Provide Eisen-Heiss 212 System, protective coating on interior of fans exposed to corrosive environment. See Schedule. Application:
- .1 Coverage:
  - .1 212 Etch Primer - 1.0 mil (wet) - 0.1 mil (dry)
  - .2 212 Finish - 4.0 mil (wet) - 2.0 mil (dry)

.3 Application Preparation:
- .1 Prepare fans for application of protective coatings in accordance with AMCA 99.
- .2 Coating to be applied in accordance with coating manufacturer's requirements.

2.3 SQUARE INLINE CENTRIFUGAL FANS (TYPE 1)

.1 Duct mounted exhaust or supply fans shall be centrifugal, belt driven inline type constructed of heavy gauge galvanized steel and include square duct mounting collars.

.2 Include two removable access panels of sufficient size to permit easy access to all interior components.

.3 Centrifugal backward inclined wheel constructed of aluminum to be statically and dynamically balanced.

.4 A NEMA 4 disconnect switch shall be provided. Factory wiring shall be provided from motor to the handy box. NEMA 7/9 disconnect switch required for use with explosion proof motors.

.5 L50 500,000 hours bearing life at maximum catalogued speed.

.6 AMCA Certified for sound and air performance and fan efficiency. Fans licensed to bear AMCA certified ratings seals.

.7 Motor to be heavy duty, TEFC high efficiency: as scheduled and in accordance with the requirements

of section15053.

.8 Accessories: as scheduled,

.9 Performance: as scheduled.

.10 Factory test fans at operating speed. Provide written record of factory test upon request.

.11 Specified Manufacturer: Twin City, Model BSI.

.12 Alternate Manufacturers:
- .1 Greenheck
- .2 Northern Blower
- .3 New York Blower.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Carry out field inspection on arrival at site, checking for structural damage and verifying electrical characteristics, unit capacities and options are as specified.

.2 Coordinate roof, wall and ceiling openings, locations and sizes and positioning of roof curbs with other trades.

.3 Install according to manufacturer’s written instructions.

3.2 CERTIFICATION, TESTING

.1 Conform to requirements of Balancing in Section 15031 and Testing in Section 15030.

.2 Make all adjustments necessary to meet specified airflow.

.3 Provide belts and pulleys required for final balancing.

.4 Manufacturer to submit certification that equipment has been installed in accordance with their requirements and is performing properly.

3.3 SUPPLEMENTS

.1 Fan Schedule included at the end of this section

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This specification covers mechanical dampers as scheduled and as indicated on the drawings.

.2 Refer to section 15930 Primary Control Devices for information on non manual actuators.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.
- .1 Air Movement and Control Association International (AMCA)
  - .1 AMCA Standard 500-D: Laboratory Methods of Testing Dampers for Rating
- .2 National Fire Protection Association (NFPA):
  - .1 NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems.
- .3 Sheet Metal and Air Conditioning Contractors National Association (SMANCA).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted sections, submit the following for all PART 2 – PRODUCTS.

.3 Operation and Maintenance Data:
- .1 Operation and Maintenance Manuals. Refer to Division 1 and Division 15, section 15014 for requirements.
- .2 Manufacturer’s installation requirements.

.4 Quality Control Data:
- .1 Manufacturer’s certified testing results.
- .2 Manufacturer’s certificate confirming proper installation.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS REQUIREMENTS

.1 The Contractor shall verify and demonstrate that proper access and maintenance can be performed on all installed dampers.

1.6 QUALITY ASSURANCE

.1 Provide material thickness and type of construction in accordance with ASHRAE and SMACNA Duct Construction Standards.

.2 Fire dampers to be listed and bear label of UL or ULC, and meet requirements of Ontario Fire Marshal and NFPA-90A.

.3 Fire dampers to be factory fabricated for fire rating requirement to maintain integrity of membrane

being pierced. Rating to be 1½ hours as defined by codes.

1.7 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements

1.8 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

1.9 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 INSULATED CONTROL DAMPERS (TYPE 1)

.1 Application: Insulated low leakage dampers to be installed in all outside air intake or exhaust openings exposed to outside air. Provide parallel blade for two-position control, opposed blade for modulating control.

.2 Damper to be rated for 0.6% leakage at 2.5 kPa, minimum 2.7 mm extruded aluminum frames, minimum 100 mm deep, double sealed bearings on 11 mm hexagonal shaft, synthetic rubber edge seals, linkage hardware installed out of airstream. Insulate hollow blades with 22 mm polyurethane foam and similarly frame blades to be constructed complete with thermal breaks. Intake damper to be a minimum of two sections with rubber seals between sections. Flanged mounting with flanges external to airstream.

.3 Refer to Section 15930 for damper actuators.

.4 Specified Manufacturer:
  .1 TAMCO, Series 9000

.5 Alternate Manufacturers:
  .1 Nailor
  .2 Ruskin
  .3 E.H. Price

PART 3- EXECUTION

3.1 INSTALLATION

.1 Provide dampers where indicated on drawings and where required for adequate system performance.

.2 Provide insulated dampers on all outside air openings including roof exhaust.

.3 Provide sawcut in the end of each damper shaft and position parallel with damper blade to indicate blade position. Attach labels on ductwork or equipment indicating open or closed damper positions.

.4 Verify operation of all dampers.

.5 Adjust linkage of insulated dampers after 11 months operation, or as required.

3.2 SUPPLEMENTS

.1 Damper Schedule included at the end of this section

END OF SECTION

CASSELMAN MAIN SPS UPGRADE
CASSELMAN, ON
JLR No.: 16953-134

MOTORIZED DAMPER SCHEDULE

SECTION: 15850

SHEET 1 OF 1

I.D.	DESCRIPTION	TYPE	ACTUATOR MANUFACTURER	OPERATION	AIR FLOW	ACTUATOR	ELECTRICAL			FIELD WORK				COMMENTS
						MIN. TORQUE	LOAD	VOLTS	PH	SUPPLIED BY	INSTALLED BY	WIRED BY	COMM. BY	
					L/s	N·m	W	V						
MD 91854	MOTORIZED DAMPER	TYPE 1	BELIMO	2-POSITION	980	2.5	7	120	1	M	M	E	G	
MD 91861	MOTORIZED DAMPER	TYPE 1	BELIMO	2-POSITION	47	2.5	7	120	1	M	M	E	G	
MD 91862	MOTORIZED DAMPER	TYPE 1	BELIMO	2-POSITION	47	2.5	7	120	1	M	M	E	G	

FIELD WORK NOTATION

M = MECHANICAL CONTRACTOR
E = ELECTRICAL CONTRACTOR
G = GENERAL CONTRACTOR
EX = EXISTING EQUIPMENT

PLOT DATE: December 4, 2024 4:02:23 PM

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

.1 Performance based upon published manufacturers data from tests carried out in accordance with ADC 1062.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Provide diffusers, registers and grilles as indicated on schedules and/or drawings.

.2 Sizes indicated are nominal. Provide correct standard product nearest to nominal for capacity, throw, noise level, throat and outlet velocity.

.3 Furnish factory prime coated steel frames for setting into fire protecting membrane. At aluminum diffusers, registers and grilles, provide 1.2 mm thick minimum steel collar up to fire damper or fire stop flap, for suspending from the basic structure independently of membrane integrity.

.4 Frames:
- .1 Steel: exposed joints welded and ground flush and completely closed.
- .2 Aluminum: extruded, mechanical fasteners and completely closed corners.
- .3 Provide full perimeter sponge rubber gaskets.
- .4 Provide concealed fasteners and operators.
- .5 Frame to match either duct mounted or surface mounted on wall as applicable.
- .6 Refer to schedule.

2.2 SPECIFIED PRODUCT

.1 Specified Manufacturer:
- .1 Type X:12 mm mesh, 2 mm (No. 14 AWG) Stainless Steel Screen Over Open Duct

.2 Specified Manufacturers:
- .1 Nailor
- .2 Titus

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Coordinated installation of units with ceiling construction.

.2 Fit frames tightly to prevent leakage and smudging.

.3 Visible screw fasteners to be countersunk and with matching finish.

.4 Properly support units and coordinate with ductwork.

.5 Carry out installation in accordance with manufacturer's requirements.

.6 Carry out installation of fire rated equipment in accordance with code requirements.

.7 Coordinate insulation and access provisions with integral balancing dampers.

END OF SECTION

IDENT	SERVICE				DESCRIPTION	FINISH AND ACCESSORIES
	SA	RA	EA	TA		
X	●		●		2 mm, 12 mm STAINLESS STEEL WIRE MESH	MILL FINISH

PART 1 – GENERAL

1.1 QUALITY ASSURANCE

.1 Conform to NFPA, ULC, CGSB and CSA requirements.

.2 Filter Efficiency: ASHRAE 52-76.

.3 Air Filter Capacity: Air Filter Institute (AFI) Test.

1.2 SUBMITTALS

.1 Submit the following shop drawings:
- .1 Inline Filter Box
- .2 Filter Media
- .3 Frame Assemblies

PART 2 – PRODUCTS

2.1 DUCT MOUNTED INLINE FILTERS

.1 Provide inline duct mounted pleated panel filter. MERV 8 to ASHRAE 52.2, UL listed with filter holding frame sizes and locations as indicated on drawings.

.2 Media: Cotton and synthetic fiber blanket, 50 mm thick.

.3 Recommended changeout pressure drop 248 Pa at 500 fpm.

.4 Maximum continuous operating temperature 93°C.

.5 Frame: 1.519 mm (16 ga.) galvanized steel with gasketed filter seal flange, accommodates variety of fasteners.

.6 Specified Product: Camfil 30/30 with Type 8 Filter Holding Frame.

2.2 FILTER GAUGES

.1 Refer to Division 16.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Install filter boxes where indicated on drawings in accordance with manufacturer's recommendations.

.2 Provide replacement media and install upon acceptance of system.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION SUMMARY

.1 This specification covers building mechanical control devices. Provide all control devices and primary control elements to be per the equipment schedules, drawings, and as identified herein. All associated wiring to field devices by Division 16.

.2 Controls to go to failsafe position on equipment failure.

.3 Control Devices – additional general requirements:

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, vibration-proof, assembly.
- .3 Operating conditions: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

1.2 REFERENCES

.1 The following is a list of standards utilized in this section. Unless otherwise specifically noted, the references indicated shall be the latest standard adopted by the regulatory agency as of tender date.

- .1 National Fire Protection Association (NFPA):
  - .1 NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B: Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .2 Underwriters' Laboratories (UL):
- .3 National Electrical Manufacturer's Association (NEMA).

1.3 INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Division 1 and Division 15, Section 15010.

.2 In addition to the submittal requirements identified in the above-noted section, submit the following for all PART 2 – PRODUCTS.

.1 Product Data:

- .1 Relevant information to confirm that the specifications have been met. Identify all deviations.

.2 Operation and Maintenance Data:

- .1 Operation and Maintenance Manuals. Refer to Division 1 and Division 15, section 15014 for requirements.
- .2 Manufacturer's installation requirements.

.3 Quality Control Data:

- .1 Manufacturer's certified testing results.
- .2 Manufacturer's certificate confirming proper installation.

1.4 CLOSEOUT SUBMITTALS

.1 Refer to Division 1 for General Closeout Requirements.

1.5 MAINTENANCE AND SPARE PARTS

.1 The Contractor shall verify and demonstrate that proper maintenance can be performed on all installed controls.

1.6 COMMISSIONING

.1 Refer to Division 1 and Section 15010 for Commissioning Requirements

1.7 TRAINING

.1 Refer to Division 1 and Section 15010 for Training Requirements.

.2 Training required for all Part 2 equipment

1.8 WARRANTY

.1 Refer to Division 1 and Section 15010 for Warranty Requirements.

PART 2 - PRODUCTS

2.1 TWO POSITION DAMPER ACTUATOR

.1 Direct coupled 120 V actuator to be mounted over damper shaft using V-bolt and Cradle type mounting; spring return; provide means to manually operate actuator when not powered; 2-year warranty; visual position indicator.

.2 Provide all mounting brackets and shaft mounting hardware and control transformer where required.

.3 Mount outside insulation on insulated ducts.

.4 Outside damper actuators to be open/close two position. Provide position switches to indicate open/close status. Each switch to be a Form ‘C’ dry contact rated for a minimum of 120 V, 5 A.

.5 Provide NEMA 4X housing for motorized damper actuators where scheduled.

.6 Refer to MID drawings, P&ID drawings and equipment schedules.

.7 Specified Manufacturer: Belimo.

.8 Alternate Manufacturer:

.1 Neptronic,

.2 Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide complete system of automatic controls to achieve sequence of operation, monitoring and alarming specified.

.2 Mount motorized dampers outside insulation on insulated ducts.

.3 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.4 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

3.2 TESTING ADJUSTMENTS

.1 After completion of installation, test, adjust and regulate thermostats, dampers and other control or safety equipment provided under this Section.

.2 Adjust to suit balancing of systems.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Definition: Related Work does not define the responsibility of providing but rather refers to standards of materials and installation required. Refer to Part 2 of the appropriate section for responsibility of providing the material and Part 3 for responsibility of installation.

.1	General Requirements:	Division 1
.2	Equipment to be Salvaged:	Division 1
.3	Excavation and Backfill:	Division 2
.4	Concrete Work/Formwork/Reinforcing:	Division 3
.5	Painting:	Division 9
.6	Grounding:	Section 16045
.7	Electrical Inspection and Testing:	Section 16031

1.2 DEFINITIONS

.1 Following are definitions of terms and expressions used in specification:

- .1 "Inspection Authority" means agent of any authority having jurisdiction over construction standards associated with any part of electrical work on site.
- .2 "Supply Authority" means electrical power company or commission responsible for delivery of electrical power to project.
- .3 "Electrical Code" means Ontario Electrical Safety Code Latest Edition.
- .4 "as indicated" means as shown on drawings.
- .5 "as specified" means as specified elsewhere in specification.
- .6 "provide" means supply, install and connect.
- .7 "Process Equipment" means any motor, operating station, instrument, etc. used in the process of treating wastewater and/or its byproducts.
- .8 "House Equipment" means any devices such as lights, switches, receptacles, heaters, etc. that forms part of the building system and is not used directly in the process of treating wastewater and/or its byproducts.
- .9 "Manufacturer's Representative" means factory trained person who can start up a particular device from a particular manufacturer. Manufacturer must provide written confirmation of a representative not in their direct employment.

.2 Refer to CSA C22.2 No. 0 for "Definitions and General Requirements".

1.3 ABBREVIATIONS

.1 BS means British Standard.

.2 CEC means Canadian Electrical Code.

.3 CEMA - see EEMAC.

.4 CGSB means Canadian General Standards Board.

.5 CSA means Canadian Standards Association.

.6 EEMAC means Electrical and Electronic Manufacturers Association of Canada.

.7 NBC means National Building Code.

.8 OBC means Ontario Building Code.

.9 ISA means International Society of Automation.

.10 OESC means Ontario Electrical Safety Code and its bulletins, latest revision.

1.4 ELECTRICAL ABBREVIATIONS

.1 Following abbreviations are used for electrical terms:
- .1 ac alternating current.
- .2 awg American wire gauge.
- .3 A ampere.
- .4 am/fm amplitude and frequency modulation.
- .5 db decibel.
- .6 dc direct current.
- .7 Hz hertz.
- .8 kV kilovolt.
- .9 kVA kilovolt-ampere.
- .10 kW kilowatt.
- .11 kWh kilowatt-hour.
- .12 m meter.
- .13 mA milliampere.
- .14 mm millimeter.
- .15 rms root-mean-square.
- .16 V volt.
- .17 W watt.

.2 Following abbreviations are used for equipment:
- .1 MCC Motor Control Centre.
- .2 DTT Dry Type Transformer.
- .3 SG Switchgear.
- .4 SB Switchboard.

1.5 CODES AND STANDARDS

.1 Carry out all work in accordance with these drawings and specifications, meet latest regulations of Electrical Code and applicable Municipal and Provincial Codes and Regulations. In each and every instance of application, the Code, Regulation, Statute, By-Law or Specification having most stringent requirements applies.

1.6 PERMITS AND FEES

.1 Submit to Inspection Authority and Supply Authority necessary number of working drawings and specifications for examination and approval prior to commencement of work and pay all associated fees. These documents to be provided by Consultant at no cost.

.2 Obtain and pay for all inspection fees.

1.7 ELECTRICAL SYSTEM SUPPORT ANCHORAGE AND SEISMIC RESTRAINT

.1 Refer to Division 1.

.2 Provide support, anchorage and restraint of Electrical distribution systems and equipment, designed and constructed in accordance with the latest edition of the following:

- .1 National Building Code, Section 4.1.8.
- .2 Ontario Building Code, Section 4.1.8.
- .3 ASHRAE Applications, Seismic Restraint Design.

.3 Provide installation documents prepared by a Structural Engineer licensed in the Province of Ontario. Documents to provide all required seismic supports, fastenings and bracings. For the proposed installations, documents to be sealed and signed by the Structural Engineer and submitted as part of the shop drawing package for review prior to commencement of any work.

.4 Coordinate electrical system support, anchorage and restraint system with the requirements and constraints of the structure, vibration isolation systems and the support, anchorage and restraint systems for mechanical and architectural components of the building.

.5 At completion of project, provide confirmation in writing, signed and sealed by a Structural Engineer licensed in the Province of Ontario stating that the Electrical installation is in general conformance with the structural drawings submitted with the shop drawing package.

.6 The following items are to be specifically addressed:

- .1 Anchoring of MCCs.
- .2 Installation of Cable Trays.
- .3 Installation of UPSs and EBUs.
- .4 Installation of Control Panels.
- .5 Installation of Junction Boxes
- .6 Installation of Lighting Fixtures.
- .7 Installation of Unit Heaters.

1.8 PRODUCT DATA AND SHOP DRAWINGS

.1 As per Division 1.

.2 Show on product data and shop drawings, details of construction dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Wiring drawings showing interconnection with work of other divisions are required.

.4 Submit product data and/or shop drawings for all electrical equipment (Divisions 16 and 17) and devices supplied under this contract.

1.9 OPERATION AND MAINTENANCE DATA

.1 As per Division 1.

.2 Include in manuals, information based on following requirements:

- .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features and component function and maintenance requirements to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
- .2 Technical data to be in the form of reviewed product data supplemented by bulletins, technical descriptions of items, and parts lists. Advertising or sales literature will not be acceptable.

.3 Include copies of all product data and shop drawings.

.4 Provide wiring and schematic diagrams and performance curves.

.5 In addition to printed copies, all O&M manuals to be compiled in electronic format (PDF) structured in logical directories and provided on compact disk(s).

1.10 MAINTENANCE MATERIALS

.1 As per Division 1.

.2 Maintenance materials are required, as specified in Part 1 of appropriate sections.

1.11 RECEIPTS

.1 Turn over to Owner and obtain receipts for:

- .1 Maintenance materials.
- .2 Portable equipment specified.
- .3 Tagged keys for all equipment supplied with locks.
- .4 Spare lamps.
- .5 Fuses.

.2 Submit photocopies of these receipts with final Certificates of Approval

1.12 DELIVERY AND STORAGE

.1 Store all equipment indoors in a clean, dust-free, dry space in full compliance with manufacturers' recommendations and guidelines.

.2 Ship and store floor-mounted equipment in upright position.

.3 Ship channel bases and templates in advance of equipment.

.4 Keep doors locked, meters and the like protected from damage and dust.

1.13 CARE, OPERATIONS AND START-UP

.1 Instruct Owner or designated personnel in operation, care and operation of installation at times arranged with Owner.

.2 Arrange and pay for services of manufacturer's factory representative to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Where a factory representative is required, this is specified in appropriate section.

.4 Provide these services for such period and for as many visits as necessary to put installation in working order, and to ensure that operating personnel are conversant with all aspects of its care and operation.

1.14 PROJECT RECORD DOCUMENTS

.1 As per Division 1.

.2 Indicate on As-Constructed Drawings location of all buried services either discovered or installed under this contract. This information is to be certified correct by Consultant before backfilling commences.

.3 Show interconnection of mechanical and electrical components on As-Constructed Drawings.

.4 Indicate in red on Record Documents all changes from work as indicated. Include all changes made by Addendum or Change Order.

.5 These documents will be reviewed by Consultant and considered as part of the contract when reviewing monthly progress payments.

.6 Should the Contractor fail to provide satisfactory As-Constructed Drawings, these will be prepared by the Consultant at the expense of the Contractor.

.7 The Consultant will provide Contractor with two (2) sets of white prints on award of contract.

.8 Contractor to use one set for recording changes during construction. The changes to be transferred to the second set as As-Constructed Drawings. Both sets of prints to be returned to Consultant.

1.15 APPROVAL OF MATERIALS

.1 Refer to Division 1.

1.16 COOPERATION

.1 Schedule execution of work with associated work specified in other divisions.

1.17 RATINGS

.1 Operating voltages to be within those defined in CAN3-C235.

.2 All motors, electric heating, control and distribution devices and equipment provided under this contract to operate satisfactorily at 60 Hz within normal operating limits established by above standards. Equipment must be able to operate in extreme operating conditions as defined in standard without damage to equipment.

1.18 QUALIFICATIONS

.1 Contractor to have qualified personnel to continuously direct and monitor all electrical work.

.2 Contractor may be required to list names and qualifications of supervisory personnel on tender form.

.3 Supervisory personnel to attend all site meetings.

1.19 PRODUCTS, MATERIALS AND EQUIPMENT

.1 Refer to Division 1 for the following definitions:
- .1 Specified manufacturer/supplier.
- .2 Standard of Acceptance.
- .3 Acceptable Manufacturers/Suppliers.

.2 Most of the equipment in Divisions 16 and 17 has been through an extensive review with multiple manufacturing companies and the equipment listed meets pricing and performance criteria established for this project, specifically lighting, conduits, instruments, cabinet components and UPSs submission have been made and reviewed for multiple manufacturers. Only Acceptable Manufacturers/Suppliers have been listed.

PART 2 – PRODUCTS

2.1 GENERAL

.1 All equipment and material to be new, CSA certified, manufactured to minimum CSA standard quoted including additional specified requirements.

.2 Where there is no alternative to supplying equipment which is not CSA certified, submit such equipment to Inspection Authorities for special inspection and obtain approval before delivery of equipment to site.

.3 All control panels and component assemblies to be shop manufactured and CSA certified.

.4 Use material and equipment available from regular production by manufacturer concerned except where custom designed equipment is specified.

2.2 IDENTIFICATION

.1 Identify all electrical equipment supplied under this Division. Hand-painted identification will not be accepted.

.2 Use phenolic plastic laminate, machine engraved nameplates attached with self-tapping screws.

.3 Use white plates with black characters for normal power and red plates with white characters for emergency power.

	DIMENSIONS	# LINES	LETTER HEIGHT
Size 1	10 x 50 mm	1	3 mm
Size 2	13 x 75 mm	1	5 mm
Size 3	13 x 75 mm	2	3 mm
Size 4	20 x 100 mm	1	8 mm
Size 5	20 x 100 mm	2	5 mm
Size 6	25 x 125 mm	1	12 mm
Size 7	25 x 125 mm	2	7 mm
Size 8	50 x 150 mm	1	25 mm
Size 9	75 x 150 mm	2	19 mm

.4 Wording on nameplates to be approved by Consultant prior to manufacture.

.5 Allow for average of twenty-five (25) characters per nameplate.

.6 All identification to be in English.

.7 Panel nameplates, size 7, to identify panels, as indicated, and voltage characteristics.

.8 For distribution panels provide a nameplate, size 5, for each circuit appropriately engraved identifying equipment or panel controlled.

.9 For branch circuit panels provide a typed directory inside door of each panel stating type of load and room location for each circuit. Supply a protective plastic envelope for directory.

.10 Identify circuit numbers on back of receptacle and switches with wire markers.

.11 Correct existing panel legends and nameplates to reflect changes made.

.12 Transformer nameplates, size 7, to show capacity, primary and secondary voltages.

.13 Nameplates, size 5, for disconnect switches, splitters and contactors to indicate equipment being controlled, voltage characteristics, ampere or horsepower kilowatt rating of equipment.

.14 Nameplate for each stand-alone starter to be size 1 engraved "name of equipment controlled".

.15 Nameplate on each remote control device to be size 1 engraved "name of equipment controlled".

.16 Nameplates, size 5, for terminal cabinets, pull boxes and junction boxes to indicate system and/or voltage characteristics.

.17 At underground penetrations, size 9 on outside wall stating description of feed(s), and their supply

source.

.18 Provide self-adhesive labelling of receptacles and switches identifying source panelboard and circuit. Submit shop drawings prior to implementation.

.19 Provide lamacoid labelling for each house services junction box. Label to list all circuits and associated panelboards spliced inside the junction box.

2.3 WIRING IDENTIFICATION

.1 Provide phase identification markings on both ends of phase conductors of feeders. Arrange uniform phase-to-main lug connection on all equipment, i.e. panelboard, starter, disconnect switches, etc.

.2 Provide numbered tape markings on all branch conductors including neutrals. Where common neutrals are used, identify branch circuit numbers.

.3 The following colour coding of conductor insulation is to be strictly adhered to:

Phase A	-	red
Phase B	-	black
Phase C	-	blue
Neutral	-	white
Ground	-	green

.4 At all junction boxes, splitters, cabinets and outlet boxes, maintain identification system.

2.4 CONDUIT IDENTIFICATION

.1 Colour code all conduits and teck cables.

.2 Coding to be located on all conduits and cables exposed after completion of building and in suspended removable ceilings.

.3 Coding to be plastic tape or paint at all points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.4 Colours to be 25 mm wide prime colour and 13 mm wide auxiliary colour.

	Prime	Auxiliary
Up to 250 V	yellow	
Up to 600 V	yellow	green
Telephone	green	
RF Antenna Signal	green	red
Ethernet CAT6	blue	
Ethernet Fibre	blue	red
Device Net	blue	green
Modbus/RS485/RS232	blue	yellow
Intruder Alarm	red	yellow
Process Discrete	green	blue
Process Analog	green	yellow

.5 For conduits containing multiple systems, request direction from the Consultant in writing.

.6 For all cables/conduits in the cable schedule label include tag using Electrovert Uni-Labels, mounting strips, lettering 12 mm, black letters, secure with Ty-Wraps.

2.5 LABELS AND SIGNS

.1 Manufacturers' nameplates and CSA labels to be visible and legible after equipment is installed.

.2 Provide warning signs, suitable background colour and lettering as required to meet requirements of Inspection Authority and Consultant. Use porcelain enamel signs, minimum size 180 mm x 250 mm.

2.6 FINISH

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.

.2 Clean and prime exposed hangers, racks, fastenings, etc. to prevent rusting.

.3 Paint all outdoor equipment to EEMAC Y1-1.

.4 Paint all indoor equipment to EEMAC 2Y-1.

.5 Do not paint “process equipment” conduits or cabling. These include those connecting plant instrumentation and motorized equipment. Process equipment cabling and conduits are typically installed on cable trays and Unistrut brackets. All painting work shall be coordinated between Divisions 9 and 16.

2.7 TERMINATIONS

.1 All lugs, terminals, screws used for termination of wiring must be suitable for either copper or aluminum conductors.

2.8 CABLE TRAY IDENTIFICATION

.1 Provide comprehensive cable tray labelling as follows:
- .1 Provide a Size 9 lamacoid at 6 m intervals and where the cable tray stops at walls, ceilings or floors. The lamacoid shall contain the following information:
  - .1 Brief description of the types of systems associated with each cable. Example: Fibre, 600 VAC power, VFD cable, UPS power, DC controls, etc.
  - .2 List of all cables in the tray at the location of the label.
- .2 Number of lines on the lamacoid label to suit.
- .3 Submit shop drawings for review.
- .4 Secure lamacoid to the side of the tray so it is clearly visible without the need to use ladders or other elevation aids as best as practical.

2.9 EQUIPMENT LABELLING

.1 In addition to other labelling requirements, provide comprehensive labelling at each piece of process, house services, electrical and mechanical equipment that is fed from a panelboard, MCC, MCP, CP, switchboard or switchgear. The label shall include:
   .1 The equipment tag.
   .2 Power source, example: panelboard tag.
   .3 Circuit, where applicable.

.2 Labels to be Size 9. Number of lines to suit.

.3 Submit shop drawings for review.

PART 3 - EXECUTION

3.1 REFERENCE STANDARDS

.1 Do complete installation to The Ontario Electrical Safety Code and its bulletins, latest edition.

3.2 INSTALLATION

.1 Determine manufacturer's recommendations regarding storage and installation of equipment and adhere to these recommendations.

.2 Check all factory joints and tighten where necessary to ensure continuity.

3.3 INSPECTION AUTHORITY

.1 Obtain a Certificate of Acceptance from Inspection Authority upon completion of work and hand it over to Consultant.

.2 Notify inspection authority in sufficient time for them to inspect work.

.3 Consultant will carry out inspections and prepare deficiency lists for correction by Contractor during and on completion of construction.

.4 Contractor to correct deficiencies and advise the Consultant in writing that they have been corrected.

3.4 TESTS

.1 Conduct tests and pay for all work associated with the following for those items installed under this contract. Provide Consultant with 48 hours written notice prior to tests required to be witnessed.
   .1 Complete power distribution system including phasing, meggering, voltage, grounding and load balancing / as-constructed load measurements.
   .2 All new circuits originating from branch distribution panelboards.
   .3 All lighting and its control.
   .4 All motors, heaters and associated control equipment including sequenced operation of systems where applicable and verification of correction over-current and overload pretesting devices.
   .5 Complete operation of all systems including Ethernet, security, access control, etc.

.6 Obtain from manufacturers, certificates or letters confirming that entire installation as it pertains to each system has been installed to their satisfaction.
.1 MCCs.
.2 UPSs and associated EBUs.

.2 Provide all instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.3 Refer to Section 16031 and equipment specifications for a complete scope of inspection and testing.

3.5 INSULATION RESISTANCE

.1 Megger all circuits, feeders and equipment up to 350 V with a 500 V instrument and from 350-600 V with a 1000 V instrument. Ensure that insulation resistance to ground is not less than required by code before energizing.

.2 Approval of insulation between conductors and ground, and efficiency of grounding system is left to discretion of Inspection Authority.

3.6 LOAD BALANCE

.1 Measure and record phase current to all panelboards with normal loads operating at time of acceptance.

.2 Measure and record phase voltages at normal load and adjust transformer taps to obtain, within 2%, rated voltage of equipment.

.3 Measure and record primary and secondary currents of transformers.

.4 Submit a written report at completion of work to Consultant containing all phase and neutral currents and voltages, for panelboards, dry-type transformers and motor control centres, operating under normal load. State hour and date on which each load was measured.

3.7 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow 150 mm minimum horizontal clearance between boxes.

.2 Location of outlets indicated may be changed by Consultant at no extra cost or credit, providing distance does not exceed 3000 mm, information is given before installation, and construction similar.

.3 Check direction of door swings from architectural drawings and on site. Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms, on latch side of door.

.4 Make all necessary adjustments when interior finish is completed.

.5 In acoustic tile and inverted "Tee" bar ceilings locate equipment in centre of tile or on "Tee" bar. Obtain location ruling from Consultant if other than above.

3.8 MOUNTING HEIGHTS

.1 Mounting height of equipment is given from finished floor to centreline of equipment.

.2 Exact mounting height of unnoted equipment must be verified with Consultant before proceeding with installation.

.3 Where outlets occur at same location, or on same wall, or part of wall, locate outlets symmetrically and at comparable heights disregarding specified mounting heights.

.4 Install electrical equipment at heights outlined below unless otherwise indicated.

.1	Local Switches	1200 mm
.2	Wall Receptacles/Telephone and Data Outlets	
.1	In service rooms and process areas	1200 mm
.3	Cabinets	1500 mm

3.9 PROTECTION

.1 Protect exposed live equipment such as panel mains and outlet wiring during construction for personnel safety.

.2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage.

.3 Arrange for installation of temporary doors for all rooms containing electrical distribution equipment. Keep these doors locked at all times except when under direct supervision of electrician.

3.10 MOTOR ROTATION

.1 Rotate motors in direction indicated by equipment being served.

3.11 CONDUIT SLEEVES AND HOLES

.1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete floors to be plastic pipe, sized for free passage of conduit, and protruding 50 mm (or as indicated) above finished floor.

.2 Holes through exterior walls and roof to be flashed and made waterproof. Seal inside the conduit with suitable compound to prevent entry of water through conduit.

.3 Install all cables, conduits and fittings, which are to be embedded or furred in, neatly and closely to building structure so that necessary furring can be kept to minimum.

3.12 FIREPROOFING

.1 Where cables or conduits pass through floors and fire rated walls, pack space between cables or conduits and sleeve or opening with T&B Flame-safe firestop material or 3M CP25 or 303.

3.13 CUTTING AND REPAIRING

.1 As per Division 1.

.2 Assume full responsibility for laying out electrical work and for any damage caused by incorrectly located equipment or improper performance of this work.

3.14 CLEANING

.1 As per Division 1.

.2 Clean all outlets, cabinets, enclosures, tubs, etc. of construction materials.

.3 Clean and remove paint from all cover plates and wiring devices.

.4 Clean up daily all waste materials and remove from site.

3.15 USE AND PERMANENT SYSTEM

.1 The connection points and use of the permanent electrical system for construction power or lighting is to be approved by the Consultant.

.2 When permanent lighting is used prior to turning building over for occupancy, all fixtures to be cleaned.

3.16 SCOPE OF WORK

.1 The scope of work for this contract shall include all work indicated on the drawings and includes but is not limited to the following. Such drawings include E, I, ME, MID, N and PID series as well as other series as indicated.

.2 Coordinate with the Mechanical Contractor for monitoring relays for pumps. Mechanical Contractor to turn over such relays to the Electrical Contractor for installation inside the MCCs.

.3 Site Wide Systems and Studies:

- .1 Provide a new turnkey 600V MCC retrofit as indicated. This system includes new sections for VFDs, new breakers, new compartment for Exhaust fans VFDs, new compartment for Ethernet switch. The Contractor shall carefully plan and implement the new MCC layout. Contractor to coordinate the MCC retrofit with existing MCC manufacturer, any other manufacturer is not acceptable.
- .2 Provide new interior lighting in new Electrical room, including associated controls.
- .3 Provide new communications networks at the pumping station and at the Lagoon, including Ethernet.
- .4 Provide new PLC panel, associated instrumentation and miscellaneous control panels as outlined.
- .5 Provide new PLC rack and associated miscellaneous components inside existing chemical control panel at the Lagoon as outlined.
- .6 Provide new wiring for the new Compactor as outlined.
- .7 Provide UPS systems complete with UPS power distribution inside PLC control panel.
- .8 Provide a Short-Circuit Coordination and Arc Flash Study per Section 16030.

.9 Provide Power Factor Study as per Section 16410.

.10 Provide a Harmonic Study:

.1 Establish a documented record of base line performance of the electrical system upon project completion by measuring the harmonic performance of the system, under daily operational process loading conditions at the point of turn-over to the owner, of the supply circuit (TDHi) and bus voltage (THDv) for the following major electrical bus and MCC-100.

.2 Submittals to be included in Operations and Maintenance manuals are expected to be a 5 minutes average using typical Fluke power quality meters applied by the contractor with harmonic Voltage and Current profiles up to 49th harmonic. Measured average THDi / THDv shall be indicated in addition to the measured average harmonic profile at the date / time of the measurement. Observed plant maximum flow conditions and operational major plant motor loads should also be noted to support the level of loading on the electrical bus at the time of measurements.

.3 This submittal shall demonstrate that provided equipment under the contractor's scope, as an assembled system, are in compliance with IEEE 519 standards and therefore aimed at supporting the completed works of the General Contractor. In the rare event of unexpected electrical equipment failure during the subsequent warranty period, these documented submittals will assist in eliminating a measure of uncertainty in determining the cause of such failures.

.11 Provide all required documentation for all newly provided intrinsically safe circuits within classified areas. All documentation required by ESA shall be provided by the contractor as required for ESA final acceptance of intrinsically safe circuits placed into service.

.4 System Integration:

.1 Refer to Section 17002 and Division 1 for further details.

.5 House Services:

.1 Provide all equipment, devices, wiring and all associated appurtenances for house services, as indicated.

.2 Provide all wiring and associated controls and appurtenances for HVAC systems in the plant, as indicated.

.6 Demolition and Construction Sequencing:

.1 The Electrical Contractor shall provide demolition services as indicated. Note that the demolition drawings are based on as-built drawings from previous projects and may not reflect the exact state of the existing systems and infrastructure as it exists today. The Electrical Contractor is responsible for visiting the site prior to close of tender to obtain a thorough understanding of the scope of demolition, including its impact on construction sequencing. The Electrical Contractor is reminded that the undisturbed operation of the Main SPS and Lagoon takes precedence over all construction activities and as such the Contractor is to carefully coordinate with all personnel as required, to implement the intended upgrades.

.2 Demolish electrical infrastructure associated with equipment identified for demolition, as indicated.

.3 Provide temporary wiring as required to facilitate construction.

.7 Provide Construction sequence for Lagoon metering SLC/5 controller replacement for Consultant approval as per Division 1.

.8 Temporary Power and Utility Coordination:

.1 Provide temporary power as required to facilitate construction. This includes temporary standby

power, as required.

.2 Provide temporary UPS power as required to facilitate construction.

.3 Smoke and heat Detection and Monitoring:

.1 Provide smoke detection and monitoring in Electrical room as outlined.

.9 Provide a shop drawing showing the proposed detailed layout for the electrical pump room for review prior to procuring any equipment for that room. Shop drawing to include the following:

.1 Exact dimensions for each piece of electrical equipment as well as proposed clearances.

.2 Provide an elevation drawing for each wall as well as a plan drawing for the room.

.3 Labelling for each piece of equipment in the room.

.4 Housekeeping pad dimensions (elevations and footprint).

.5 Cable tray routing.

.6 Locations of lighting fixtures.

.7 Location of any Mechanical equipment (including A/C units and ductwork) as well as Structural members (including columns and beams).

.10 Note that work is required in various areas of the plant, as indicated.

.11 Coordinate with the General, Mechanical and System Integrator for the preparation of shop drawings and installation of items outlined:

.1 Section 15349.

.2 Motor Starters and Control List.

.3 Control and Instrumentation Material.

.4 Table of Devices.

.5 Table of Panels and Electrical Equipment.

.6 HVAC motors and Starters Packages

Provide installations in full compliance with the latest edition of the Ontario Electrical Safety Code and its bulletins as well as all specifically identified Plan Approval requirements.

3.17 NETWORKING SPECIALIST

.1 Retain the services of a Corning-approved Networking Specialist to provide the following:

.1 Terminate all CAT 6 Ethernet cables.

.2 Test and commission all Ethernet connections.

.3 Provide commissioning documentation.

.2 Scope of work in accordance with Section 17060 and drawings.

3.18 SYSTEM INTEGRATOR

.1 Retain the services of a Systems Integrator (SI) to provide the following:

.1 PLC and HMI programming, as outlined.

.2 All CPs, UPS(s), process control junction boxes and instruments as indicated on drawings.

.3 All Division 17 devices.

.4 During start-up and commissioning, actuate all field devices supplied.

.5 Commissioning documents to include the following:

.1 Upper and lower range settings of all instrumentation supplied.

.2 All settings of all devices commissioned.

.6 As part of the as-built information, the following shall also be included:
  .1 Serial number for each device.
  .2 Make and model for each device being supplied.
  .3 Date (month and year) of manufacture of each device being supplied.

.7 Factory Acceptance Testing (FAT):
  .1 Provide FAT for each of the following:
    .1 All CPs.
  .2 J.L. Richards & Associates Limited (JLR) has allowed for two (2) visits to the SI's facility for FAT. Any additional visits required to resolve issues with the panels may be at the expense of the Contractor.
  .3 Provide a minimum of two (2) weeks notice to the Consultant for each FAT.

.8 Provide PLC and HMIs programming and commissioning as outlined in Division 17.

.9 Assist with the commissioning and performance trials.

.2 Acceptable System Integrator:

.1 Contractor is to retain the services of Capital Controls & Instrumentation as the sole supplier of systems integration services for these projects as defined by the contract documents. Refer to the Form of Tender for costings.

3.19 SECURITY SYSTEM SPECIALIST

.1 Retain the services of a Security System Specialist to provide security system as indicated. The final details of the security system to be coordinated with the Municipality and the Consultant during construction. Such details include the final alarm zone assignment.

.2 Acceptable Security System Specialist:

.1 Falcon Security, or approved equivalent.

3.20 ELECTRICAL SYSTEMS TESTING AGENT

.1 Retain the services of a testing agent to implement the inspection and testing requirements of the electrical power distribution system as outlined in Section 16031.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

.1 The work covered by this section of the specification is to be coordinated with the related work as specified elsewhere under the project coordination.

REFERENCES

.1 Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  .1 IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

.2 American National Standards Institute (ANSI):
  .1 ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.

.3 The National Fire Protection Association (NFPA):
  .1 NFPA 70 – National Electrical Code, latest edition.
  .2 NFPA 70E – Standard for Electrical Safety in the Workplace.

.4 Canadian Standards Association (CSA):
  .1 CSA Z462-21 – Workplace Electrical Safety.

1.2 STANDARDS

.1 The tests and inspections shall comply with NETA, International Electrical Testing Association.

.2 Burn-in periods are 100 hours for continuous use equipment or 7 days for cyclic duty equipment.

1.3 SCOPE

.1 The work covered by this section of the specification, includes the furnishing of all labour, test equipment, and performance tests for installations shown on drawings and as herein specified during and at conclusion of project.

.2 For the following items affected under this contract, test the following for proper operation and adjustments:
  .1 Cable and bus-bars.
  .2 Standby Generator.
  .3 Low voltage distribution switchgear.
  .4 Low voltage power circuit breaker and protective relays.
  .5 Automated transfer switches.
  .6 Low voltage molded case breakers.
  .7 Bus ducts.
  .8 Low voltage feeders.
  .9 Panel board circuits.
  .10 All motors, heaters and associated control equipment, including sequential operation of systems where applicable and verification of correct over current and overload devices.

.11 Uninterruptible power supply (UPS System).
.12 Power monitoring equipment.
.13 Surge Protective Device (SPD).
.14 Starters and control.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

.1 General:
- .1 Ensure suitable power supply is available for test equipment, be it 120 VAC or battery-powered devices. Record make, model, and calibration date of test instrument(s).
- .2 All test equipment to have valid calibration stickers displayed on the equipment and must be calibrated within the last 12 months by a company who regularly engages in this service.

.2 Insulation Resistance Meter (Megger):
- .1 DC megger to have insulation scale to 100,000 megohms (1000 V scale).
- .2 Output voltages on DC megger units to be 500 V, 1000 V, 2500 V and 5000 V.
- .3 DC megger units to be suitable for 10-minute megger tests and polarization index tests.

.3 Low Resistance Test Units (Ductor):
- .1 Low resistance test units to have 10 A output.
- .2 Digital display and accuracy to 1 microhm.

.4 Load Survey:
- .1 Test equipment shall be Fluke, 3-phase Power/Power Quality monitor or equivalent. With capability to harmonic measurements, amplitude and phase angle for each harmonic, watts, VA, VAR, true power factor, and displacement power factor, Power Quality standard measurements with high-speed sampling of impulses at 2 MHz to measure impulses to 6400 V peak, 500 nanoseconds duration and displays peak voltage.

.5 Phase and Rotation Testing:
- .1 Test equipment shall be adequate to safely confirm project phasing and sequence of power phase rotation.
- .2 Fluke 9040 or approved equivalent.

2.2 TESTING REPORTS

.1 Reports of all tests to be in written form.

.2 Include copy of test results in maintenance manuals.

.3 General
- .1 All test results to be input to an electronic test sheet program.
- .2 All test sheets to include equipment nameplate data, customer identification, time and date of tests, environmental conditions during tests and test results.

.4 Test Results and Reporting – Data For Inclusion

.1 The following data to be included in the test report:
  .1 Equipment data with selected position, if applicable, e.g., transformer tap.
  .2 Protective device(s) make, model number, rating, "as found" settings. These to include CT, PT relays, overloads, fuses, breakers.
  .3 Adjustments, modifications and repairs made on the equipment on site with explanation on such work (necessity and method of execution).
  .4 A summary of conclusions of the inspection and testing.
    .1 The acceptable criteria and limiting values of measured figures by the equipment manufacturer. These are to include the insulation resistance, (megohm) contact resistance (microhm), leakage current (microampere).
  .5 Recommendations for long-term and short-term remedial work.

.5 Report Format
  .1 Final report to be submitted in electronic and print format in three (3) bound copies neatly in 3-ring binders with separate sections for each item as listed therein.
  .2 Photographs to be mounted on background sheet complete with labels. Curves and graphs to be neatly plotted on appropriate graph paper. Result tables to be made electronically and logically arranged.
  .3 The enclosed test report forms are samples of the data required on the reporting forms. It is not intended to imply that these are the only forms required. The contractor to submit all forms necessary to fully describe the inspection, testing and maintenance of all items.

PART 3 - EXECUTION (TEST PROCEDURES)

3.1 GENERAL

.1 Coordination of all tests and shutdowns with Owner.

.2 (Pre-service Inspection and Testing), (Post-service Inspection and Testing) of equipment will be as described in section 2.2.

3.2 PROPOSED TESTS

.1 Insulation Resistance Tests
  .1 Use a megger with 100,000 megohm @ 1000 V resolution for megger tests.
  .2 Record ambient temperature and adjust the measured megohm reading to 20°C ambient.
  .3 Use 5kV megger for 13.2 kV equipment, 2.5 kV megger for 2.4 kV equipment and 1000 V megger range for power equipment of 600 V and below.
  .4 For 10-minute megger test, record megohm values in megohms at 30 seconds, 60 seconds, 5 minutes and 10 minutes. Plot megohms against time for each connection, calculate and record the ratio of measured megohms as follows:
    .1 60-second megohm/ 30-second megohm = dielectric absorption.
    .2 10-minute megohm/1-minute megohm = polarization index.
    .3 Report the 1-minute megohm as the insulation resistance value.
    .4 Submit tabulated measured megohm figures for 10-minute insulation tests, submit in graphical format.

.2 Low Voltage Feeder Cables
  .1 In and out of main board to be meggered at 1,000 V DC and terminals checked for torque. Any

reading less than 50 Megohms to be investigated.

.2 Insulation Resistance.

.3 Continuity Check.

.4 Proper Phasing, ABC.

.3 Cables/Busbar

.1 General

.1 Conduct inspection and testing. Compile test results in accordance with Equipment Test Schedule.

.2 Record type and size of cables on test sheets and check against the single-line drawing.

.3 Confirm all hardware to torque requirements of the manufacturer, and mark off all hardware after verification.

.2 Cabling Inspection

.1 For cables likely to have sheath current, check to ensure metal supports are not used, e.g., fiber plates used.

.2 Check all power cables, e.g., Teck cables properly spaced (by one cable diameter unless specifically indicated otherwise) and secured by proper clips.

.3 Check insulators and bushings for cracks and other physical defects.

.4 Visually inspect cables where possible throughout their run and check conditions of the following:

.1 Use of proper lugs.

.2 Cables are properly shaped without sharp bends.

.5 Open cables are properly supported on racks, trays or ladders in buildings. No concentrated stress points exist.

.6 Insulation jacket damage.

.7 Cables at duct mouth for wear or cracking.

.8 For rubber insulated cables inspect stress cones or terminations, check the following:

.1 Terminals for tightness and overheating.

.2 Stress cones and terminations for cracks, dirt, or tracking.

.3 DC Insulation Resistance 10-Minute Test

.1 Conduct tests on all 1 5kV cables.

.2 Lightning arresters to be disconnected while testing cables.

.3 Record ambient temperature. After isolating both ends of the cable to be tested, apply 10-minute insulation resistance tests with the following connections:

.1 Phase 1 to (Phase 2 + Phase 3 + Neutral + ground).

.2 Phase 2 to (Phase 1 + Phase 3 + Neutral + ground).

.3 Phase 3 to (Phase 2 + Phase 1 + Neutral + ground).

.4 Neutral to (Phase 1 + Phase 2 + Phase 3 + ground).

.4 DC High Voltage Test

.1 Conduct tests on cables where a 10-minute insulation resistance test is applicable and submit test report.

.4 Load Survey

.1 Measure and record Phase-to-Phase Voltage, Phase to Neutral Voltage, Phase Current, Neutral Current and Ground Current of the following:

.1 All 600 volt feeders.

.2 All 208 volt Panelboards.

.3 All primaries and secondaries of all dry type transformers; record tap settings.

.4 All inputs and outputs of all UPS units.

.5 All starter inputs.

.2 Measure and record Magnitudes of Harmonic Phase and Neutral Currents at all the equipment

mentioned in paragraph 3.1. Identify the current magnitudes for the 3rd, 5th, 7th, 9th, 11th, 13th, 15th, 17th, 19th and 21st harmonic (based on 60 Hz).

.3 Utilize test instruments with a maximum error of ±2% and submit two copies of typed result sheets, signed, dated and bound to the Engineer.

.4 Measure power quality standard measurements: sags, swells, and wave shape fault events, rms volts, rms amps, and frequency summaries. Transients to 1000 volts peak, 130 microseconds duration.

.5 Measure at the MCC, Power Consumption.: watts, VA, VAR, PF (true and displacement), Demand, kWh.

.5 Starters and Controls

.1 Initial Start Up

.1 Ensure that overload relays are properly sized and sired into circuit.

.2 Check all circuit protective devices.

.3 Ensure that external control wiring has been verified. Record any changes on control diagrams.

.4 Division supplying motor must be present.

.2 Tests

.1 Conduct tests in accordance with Section 16010.

.2 Verify voltage and current on starting and running cycles on each phase of supply circuit.

.3 Check rotation of motors.

.4 Operate switches and controls to verify correct functioning in conjunction with Division 15 and in presence of Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 GROUNDING SYSTEMS

.1 Bond all piping, grating, railings, and structural steel.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Grounding equipment to CSA C22.2 No. 41-Latest Edition.

.2 Copper grounding conductors to ASA G7.1-Latest Edition.

2.2 EQUIPMENT

.1 Grounding conductors to be green insulated, stranded copper, soft annealed, sized as indicated.

.2 Provide all non-corroding accessories necessary for grounding system.

2.3 MANUFACTURERS

.1 Acceptable grounding manufacturers:
- .1 Burndy Corp. Hy-ground Compression Connections.
- .2 Pre-approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Protect exposed grounding conductors from mechanical injury.

.2 Make buried connections, and connections to conductive water main as indicated.

.3 Use mechanical connectors for grounding connections to equipment provided with lugs.

.4 Install bonding wire in flexible conduit.

.5 Install grounding conductor in all power conduits.

.6 Make grounding connections in radial configuration only, with connections terminating at a single grounding point. Avoid loop connections unless explicitly indicated.

.7 Use tinned copper conductors for aluminum structures bonding is required.

3.2 EQUIPMENT GROUNDING AND BONDING

.1 Ground new MCC section.

.2 Ground control panels and junction boxes.

.3 Bond structural steel.

.4 Bond metallic piping.

.5 Bond grating and railings.

.6 As required by the Ontario Electrical Safety Code.

3.3 TESTS

.1 Perform Ductor low impedance ground continuity tests to approval of Engineer and local authority having jurisdiction over installation.

.2 Perform final grounding system resistance tests using fall of potential test method, or as otherwise appropriate to site conditions and to approval of Consultant, ESA and local authority having jurisdiction. Provide testing prior to energization of the Electrical Services Building as well as prior to final trial operation of the completed facility upgrades.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

PART 1 – GENERAL

1.1 GENERAL

.1 Dispose of demolished materials except where specifically noted otherwise.

.2 Where existing materials are to be reused, the Contractor for this division is responsible for their removal, storage, cleaning and re-installation.

.3 Where existing materials are to be turned over to the Owner, the Contractor for this division is responsible for their removal and delivery to the Owner on site.

.4 Where electrical equipment is to be demolished, the Contractor for this division is responsible to ensure that they have been isolated from the power supply prior to demolition under another division.

.5 Where some existing materials are to be retained in place, it is the responsibility of the Contractor for this division to identify the materials and equipment to remain prior to commencement of demolition.

.6 Maintain adequate structural support for equipment and material during demolition process.

1.2 MAINTAIN SERVICES

.1 It is the responsibility of the Contractor for this Division to maintain electrical services and systems at all times to areas beyond the construction area.

.2 Reinstate immediately any existing circuits disrupted during construction not intended to be removed as part of this contract.

.3 Extend, relocate, replace or modify existing wiring as required to facilitate construction at no additional cost to the Contract. Provide temporary supports, as required.

.4 Relocate or modify any existing control or electrical panel as required to facilitate construction. Provide temporary supports, as required.

1.3 RELOCATION OF EXISTING EQUIPMENT

.1 Refer to General Arrangement drawings for equipment to be relocated from other areas.

.2 Include for disconnection of electrical services to equipment and where circuit conductors are left exposed terminate in box with blank cover and identify with circuit number.

.3 Non-electrical equipment will be physically relocated by another Division.

.4 Include for reconnection of electrical services to equipment as indicated.

1.4 WIRING

.1 Remove all existing surface wiring and outlets as noted.

.2 Remove all wiring exposed where walls are removed, or openings made for doors. Reinstate affected

circuits.

.3 Where flush outlets are abandoned:
  .1 remove wire from conduit; and
  .2 boxes behind finished surface to be patched over by another division. If flush with finished surface remove the box.

.4 Remove all abandoned armoured cable, conduit and wiring becoming obsolete in the execution of this contract that is exposed or in removable ceiling spaces.

1.5 LIGHTING FIXTURES

.1 Remove existing lighting fixtures and dispose.

1.6 EQUIPMENT CONTAINING PCBS

.1 Refer to Designated Substances Report per Division 1.

.2 Equipment to be removed may contain PCBs (i.e., transformers, capacitors or fluorescent ballasts).

.3 When equipment containing PCBs is discovered, contact Consultant immediately for instructions.

.4 Store such equipment on site in a secure location as directed until such time as disposal is determined.

PART 2 – PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 – EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2 No. 126.

.2 NEMA VE 1-2009 Metal Cable Tray Systems.

.3 NEMA VE 2-2013 Cable Tray Installation Guidelines.

.4 NEMA FG 1-1993 Fiberglass Cable Tray Systems.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

.2 Submit detailed shop drawings for proposed cable tray system, including all accessories and support appurtenances.

1.3 SEISMIC RESTRAINT

.1 Installations in this section are subject to support and anchorage requirements, as directed by the seismic restraint consultant retained by Contractor.

PART 2 - PRODUCTS

2.1 ALUMINUM CABLE TRAY

.1 Cable trays shall be ladder style and shall consist of two longitudinal members (side rails) with traverse members (rungs) welded to the side rails. Rungs shall be spaced 300 mm on centre. Rung spacing in radiused fittings shall be industry standard 229 mm and measured at the centre of the tray's width. Each rung must be capable of supporting a 90 kg concentrated load at the centre of the cable tray over and above the cable load with a safety factor of 1.5.

.2 Cable tray loading depth shall be 128 mm per NEMA VE 1.

.3 Straight sections shall have side rails fabricated as I-beams.

.4 Cable tray widths as indicated.

.5 Splice plates shall be the Wedge-Lock design with 4 nuts and bolts per plate. The resistance of fixed splice connections between adjacent sections of cable tray shall not exceed 0.00033 ohm.

.6 All fittings must have a minimum radius of 300 mm.

.7 Materials and finish: straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.

.8 The cable tray system shall be capable of carrying a uniformly distributed load of 174 kg/m on a 3 m support span with a safety factor of 1.5 when supported as a simple span and tested per NEMA VE 1

Section 5.2. In addition to the uniformly distributed load, the cable tray shall support 90 kg of concentrated load at the mid-point of the span. Load and safety factors specified are applicable to both the side rails and rung capacities. Cable tray shall be made to manufacturing tolerances as specified by NEMA.

2.2 ACCESSORIES AND FITTINGS

.1 Accessories and Fittings:
  .1 Provide all bends, end plates, drop outs, vertical and horizontal risers and drops, tees, wyes, expansion plates, reducers, splice plates, hold down clamps, guides, connectors, brackets, isolator pads and all other hardware and appurtenances for a complete system. Where possible, all accessories and fittings shall be manufactured by the specified cable tray manufacturer.

2.3 SPECIFIED PRODUCT

.1 Specified product:
  .1 Eaton B-Line.

2.4 ALTERNATE PRODUCT(S)

.1 Alternate product(s):
  .1 Thomas and Betts.
  .2 Canadian Electrical Raceways.

PART 3 - EXECUTION

3.1 DETAILED DESIGN

.1 The drawings indicate a proposed routing for bid purposes. Field condition may indicate alternate routing in concentrated areas.

.2 The Electrical Contractor is to outline the outside edges of the cable tray runs with nylon rope. Coordinate this routing with the other trades. Coordinate this routing with cable buses and conduit runs.

.3 Review the proposed routing with the General Contractor, Mechanical Contractor and Consultant.

.4 It may be necessary to review various tray runs separately and possibly even phase single runs.

.5 Coordinate with other division and arrange for opening in new Electrical wall, width and depth of cable tray and run trough through opening.

3.2 GENERAL

.1 Keep number of elbows, offsets and connections to minimum.

3.3 SUPPORT SYSTEM

.1 Provide supports as required to meet Seismic Restraints as per Section 16010 as well as to meet the manufacturer's installation requirements. Locate supports to minimize deflection."

.2 Vertical supports on both sides of cable tray, or wall brackets.

.3 Lay cables in cable tray. Do not pull in.

3.4 JOINTS

.1 Use manufacturer recommended fittings to splice trays to provide:
- .1 Interior surface free of sharp burrs and projection that could damage cables.
- .2 Exterior surface free of projections that could cause personnel.

3.5 GROUNDING

.1 Provide green insulated copper ground wire throughout length of cable tray.

.2 Ground cable tray to ground wire at 6 m centres, using approved ground clamps.

.3 Ground cable tray to building steel at 15 m maximum centres.

3.6 CABLES IN CABLE TRAY

.1 Install cables individually.

.2 Secure all cables in cable tray at 6000 mm centres at entry and exit points and at change in direction. Use P clips on vertical runs at 1500 mm centres. Use Ty-raps on horizontal runs. Use weatherproof black Ty-raps for all areas.

.3 Identify cables with size 2 nameplates to Section 16010 secured at 12000 mm centres with Ty-raps.

3.7 WALL AND CEILING PENETRATIONS

.1 Do not run cable trays through walls or ceilings, unless indicated otherwise. Stop cable tray at each side of wall or ceiling slab and run cables through. Seal opening around cables as outlined.

3.8 EXPOSED SIDE RAIL ENDS

.1 Provide side rail protective caps for all exposed cable tray side rail ends below 2.2 m above the finished floor to minimize personnel injury due to these edges. Protective caps to be manufactured from a rubberized or foam material and shall have a reflective appearance.

3.9 GALVANIC CORROSION

.1 Provide all required appurtenances to prevent dissimilar metals from coming in contact and resulting in galvanic corrosion.

3.10 USE OF CABLE TRAYS

.1 Install aluminum cable trays in the areas, not containing corrosive gases or vapours. Refer to drawings.

3.11 ROOFTOP CABLE TRAY SUPPORT

.1 Provide Eaton DURA-BLOK™ rooftop support solution for cable tray support on rooftops complete with 12 mm thick neoprene pad, cut to size to prevent chafing/damage to roof membrane from contraction and expansion. Neoprene pad to be compatible with roof membrane – refer to Architectural. Maximum support span of 3 m.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 16151 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131, Type Teck 90 Cable.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

PART 2 - PRODUCTS

2.1 HOUSE SERVICES (BUILDING) WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors only.

.3 Size as indicated and per Code.

.4 XLPE RW-90; 1000 V insulation for 600 V circuits; 600 V insulation for 120/208V circuits.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:
- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:
- .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic material.

.7 Fastenings:

.1 One-hole straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
.2 Channel type supports for two or more cables at 600 mm centres.
.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:
.1 Wet, damp or dry locations.
.1 Thomas and Betts ST Series, Star-Teck jacketed metal-clad cable connector.
.2 Classified areas (Class 1, Zone 1 or Class 1, Zone 2).
.1 Thomas and Betts STX Series, Star-Teck jacketed metal-clad cable connector.
.2 Install with manufacturer recommended sealing compound, to maintain classified area rating of connector.

.9 Identification:
.1 Each conductor to be identified with a numbered stick-on exclusive number.
.2 Each cable to be identified by its cable tag and number, as indicated in the Cable Schedule, and as per Identification Requirements, specified in Section 16010.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

2.4 CONTROL CABLES

.1 This section applies to "house equipment" only. For process control. Refer to Teck cables.

.2 600 V type: stranded annealed copper conductors, #14 AWG with PVC insulation type TWH, with shielding of wire braid over each pair of conductors with sheath of aluminum interlocked armour and jacket over sheath of PVC.

2.5 VFD CABLES

.1 Use Belden Classic Foil/Braid and Symmetrical VFD Cable with Interlocked Armour (Series 12295XX) for VFDs.

.2 Aluminum armoured.

.3 Use parallel runs for sizes above 2/0.

.4 Refer to drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
  .1 In conduit systems in accordance with Section 16133.
  .2 In cable tray in accordance with Section 16114.

3.2 INSTALLATION OF TECK CABLE 0-1000 V

.1 Group cables wherever possible on cable trays.

.2 Lay cable in cable tray in accordance with Section 16114.

.3 Terminate cables in accordance with Section 16151.

.4 Do not install cables on building exterior unless otherwise explicitly indicated. Seek direction from the Consultant prior to such installation.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 16151.

3.4 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit or in mechanically protected areas.

.2 Ground control cable shield at one end only.

3.5 USE OF CABLES

.1 Process cables are defined on the drawings.

.2 For "house equipment" use:
  .1 As indicated on the drawings.

.3 For temporary cables, use
  .1 Teck or
  .2 SOOW with mechanical protection below 2 m above grade or finished floor.

3.6 SPLICING

.1 All 600 V wiring and cables shall be continuous and free of splices.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

.1 This Section refers to electrical power equipment only. Controls and Instrumentation boxes and accessories are defined in Division 17.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

PART 2 - PRODUCTS

2.1 MATERIAL STANDARDS

.1 Splitters to CSA C22.2 No. 76-M.

.2 Junction, pull boxes, and cabinets to CSA C22.2 No. 40.

.3 Enclosures CSA Type 1 to CSA C22.2 No. 14.

.4 Enclosures CSA Types 2, 3, 4 and 5 to CSA C22.2 No. 94.

.5 For "process equipment", refer to Division 17.

2.2 JUNCTION AND PULL BOXES

.1 Junction and pull boxes of welded steel construction with screw-on flat covers for surface mounting, unless noted otherwise.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Only main junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.4 Junction and pull boxes to be the same material as the associated conduits. Refer to Section 16133.

2.3 IDENTIFICATION

.1 Refer to Section 16010.

PART 3 - EXECUTION

3.1 INSTALLATION OF JUNCTION, PULL BOXES AND CABINETS

.1 Install junction and pull boxes in inconspicuous but accessible locations.

.2 Install terminal blocks or strips indicated in Type A, B, C cabinets to Section 17051.

.3 Mark location of all pull boxes on As-Constructed Drawings.

END OF SECTION

PART 1 - GENERAL

1.1 DEFINITIONS

.1 Outlet box: means sheet steel enclosure for either electric wiring or fittings, having knockout openings in either sides or back, or both, for entrance of wire in conduit, electrical metallic tubing, cable, or flexible tubing. Cover is fastened by screws, not hung on hinges.

.2 Conduit box: means cast box having threaded openings for conduit, bushings and clamps or connectors for cable or threadless openings for electrical metallic tubing and conduit.

.3 Fitting: means fitting intended to secure rigid conduit or electrical metallic tubing to enclosure or to adjacent length of rigid conduit or electrical metallic tubing. Such fitting may be integral part of conduit or other box.

.4 Conduit outlet body: means cast fitting installed in conduit systems to act as pull outlets for conductors being installed or to make 90° bends.

.5 Conduit: a raceway as defined in Section 16133.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Outlet boxes, conduit boxes and fittings to CSA C22.2 No. 18.

.2 All fittings and boxes used to be manufactured as accessories to the associated raceway and of consistent material e.g. OCAL where OCAL conduit is used.

2.2 OUTLET AND CONDUIT BOXES GENERAL

.1 Gang boxes where wiring devices are grouped.

.2 347 V outlet boxes for 347 V toggle switches.

2.3 SHEET STEEL OUTLET BOXES

.1 Electrogalvanized steel single and multi-gang device boxes for flush installation, minimum size 76 mm x 51 mm x 38 mm unless otherwise indicated.

.2 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Electrogalvanized steel utility boxes for outlets connected to surface-mounted EMT rigid heavy wall galvanized steel conduit, minimum size 102 mm x 54 mm x 48 mm.

.4 100 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 100 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

2.4 MASONRY BOXES

.1 Electrogalvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.5 CONCRETE BOXES

.1 Electrogalvanized sheet steel concrete type boxes for flush mount in poured in-place concrete with matching extension and plaster rings as required.

2.6 CONDUIT BOXES

.1 Cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface installation.

.2 Conduit box to match associated conduit.

2.7 CONDUIT FITTINGS GENERAL

.1 Bushings and connectors with nylon insulated throats.

.2 Pushpennies to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Factory "ells" where 90°bends are required for 25 mm and larger conduits.

2.8 FITTINGS FOR RIGID CONDUIT

.1 Threaded type steel couplings and fittings, to match conduit.

.2 Double locknuts and insulated bushings on sheet metal boxes.

.3 Use explosion-proof fittings in areas indicated.

2.9 FITTINGS FOR THIN WALL CONDUIT

.1 Watertight steel type connectors and couplings in concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Use FS boxes in process areas.

.2 Use boxes rated for use in Zone 1 in areas designated as Hazardous.

.3 Use OCAL fittings with OCAL conduit.

.4 Support boxes independently of connecting conduits.

.5 Fill boxes with paper or foam to prevent entry of construction material during construction.

.6 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.7 Provide correct size of openings in boxes for conduit, armoured cable connections, reducing washers not allowed.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA):
- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CSA C22.2 No. 45, Rigid Metal Conduit.
- .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
- .5 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

1.2 SEISMIC RESTRAINT

.1 Installations in this section are subject to support and anchorage requirements, as directed by the seismic restraint consultant retained by Contractor.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Rigid metal conduit (RGS): to CSA C22.2 No. 45, galvanized steel threaded.

.2 Thomas & Betts PVC coated corrosion resistant rigid galvanized steel conduit system (OCAL).

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole malleable iron straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 3 m o.c.

.4 Threaded rods, 6 mm diameter to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT in surface mounted or exposed areas. Set-screws are acceptable in concealed spaces.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

2.5 FISH CORD

.1 Polypropylene.

2.6 ROOF PENETRATIONS

.1 Prefabricated conduit sleeves sized to suit conduit at each location.

.2 Turn sleeves over to the roofer for installation in each location.

.3 Specified Manufacturer/Supplier:
- .1 Thaler Industries MEF-1 for rigid conduit.
- .2 Thaler Industries MEF-2A for flexible conduit.

.4 Coordinate with Architectural.

PART 3 - EXECUTION

3.1 USE OF CONDUITS

.1 No electrical services (power, controls or communications) shall be run in roof or floor slabs or beneath floor slabs unless specifically indicated on drawings – in such cases the Contractor shall notify the Consultant prior to such installations. Should the Contractor install such conduits without prior notification to the Consultant the Contractor may be required to correct deficiencies at its own cost.

.2 Provide OCAL conduit in the following areas or for the following systems:
- .1 As indicated on drawings.

.3 EMT can be used for house services in Electrical rooms only.

.4 RGS as indicated.

.5 Rigid PVC conduit for underground direct buried services not in OCAL.

.6 DB2 conduit for concreted duct banks.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations, when Teck is not used.

.8 Use explosion proof flexible connection for connection to explosion proof motors.

.9 Do not install conduits directly beneath or in proximity to roof decks or other structures that may be punctured by fasteners resulting in injury to the conduits. Provide sufficient spacing and barriers between conduits and such structures.

3.2 DETAIL DESIGN

.1 The drawings indicate a proposed routing for bid purposes. Field condition may indicate an alternate routing in concentrated areas.

.2 The Electrical Contractor is to outline the centreline of the OCAL conduit runs for fibre runs with nylon rope. Coordinate this routing with the other trades. Coordinate routing with tray, cable bus runs.

.3 Review the proposed routing with the fibre installer, General Contractor, Mechanical Contractor and Consultant.

.4 It may be necessary to review various OCAL runs separately and possibly even phase single runs.

.5 For outdoor buried runs, spray paint the ground to show centreline of trench proposed.

3.3 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits in drywall partitions and in ceiling plenums.

.3 Surface mount conduits in process areas.

.4 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations, when Teck is not used.

.5 Use explosion proof flexible connection for connection to explosion proof equipment.

.6 Minimum conduit size for lighting and power circuits: 19 mm.

.7 Minimum conduit size for communications cabling, including Ethernet, DeviceNet and Modbus is: 27 mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter, or if coating is damaged in any way.

.9 Mechanically bend steel conduit over 19 mm diameter.

.10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight. Coat OCAL threads with manufacturer approved products.

.11 Install fish cord in empty conduits.

.12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

.14 Repair damage to OCAL coating per manufacturer's recommendation.

.15 Install OCAL conduits to the manufacturers' recommendation. Electrical contractor to employ OCAL certified personnel for installation of the OCAL conduit system. Submit proof of OCAL training prior to commencing installation of any OCAL conduits. Only OCAL approved tools and products to be used for the OCAL conduit system.

.16 Do not install conduits on building exterior unless otherwise explicitly indicated. Seek direction from the Consultant prior to such installations.

.17 Label all conduits as outlined in Section 16010.

3.4 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.5 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.6 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize crossovers.

3.7 CONDUITS IN CAST-IN-PLACE SLABS-ON-GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.8 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

PART 2 - PRODUCTS

2.1 MATERIAL STANDARDS

.1 Manually-operated general purpose AC switches to CSA C22.2 No. 111-M and 55-M.

.2 Receptacles, plugs and similar wiring devices to CSA C22.2 No. 42-M.

2.2 SWITCHES

.1 Industrial (Extra Heavy Duty) Use:
  .1 Toggle Switches 20 A, 120 V. Specified Product(s):
    .1 Single pole: Hubbell HBL1221 Series;
    .2 Double pole: Hubbell HBL1222 Series;
    .3 Three-way: Hubbell HBL1223 Series;
    .4 Four-way: Hubbell HBL1224 Series;
    .5 Key switch: Hubbell HBL122? RKL Series. Number of poles to suit;
    .6 Momentary Control Switch: HBL1557 Series.

.2 Alternate Product(s):
  .1 Leviton equivalent.

.3 Colour to be brown in process areas and white in areas designated for recessed conduits.

.4 In hazardous areas and outdoors, use:
  .1 Crouse-Hinds EDS Series with general use snap switches, front operated.

2.3 RECEPTACLES

.1 “Non-controlled”:
  .1 Duplex receptacles to be industrial grade heavy duty complete with the following features:
    .1 One piece brass integral ground strap.
    .2 Triple wipe brass contacts.
    .3 Suitable for #10 AWG for back and side wiring.
    .4 Non-tamper resistant.
    .5 Impact resistant thermoplastic cover and body.
    .6 Provide wet location cover plates in all process and damp/wet areas as well as exterior. Provide required appurtenances to meet OESC’s requirements per 26-702(2).
    .7 Refer to drawings for additional requirements.
    .8 Specified Products:

.1 Non-GFCI: Hubbell HBL 5?62 Series heavy duty receptacles.
.2 GFCI: Hubbell GF5?62 Series heavy duty, industrial grade GFCI receptacle.
.9 Alternate Product(s):
.1 Leviton equivalent.
.2 Colour to be brown in process areas and white in areas designated for recessed conduits. Receptacles fed from UPS power to be blue.

.2 “Controlled”:
.1 Commercial grade duplex receptacle for controlled applications.
.2 Complies with ASHRAE 90.1 and the OBC.
.3 Permanently marked with universal power symbol and the word “CONTROLLED” to visually identify receptacles used in automatic energy management systems.
.4 Markings can be read regardless of mounting orientation.
.5 Non-tamper resistant.
.6 Suitable for #10 AWG for back and side wiring.
.7 Refer to drawings for other requirements.
.8 Green in colour.
.9 Two (2) controlled faces.
.10 Specified Product:
.1 Hubbell BR?? C2GN Series.
.11 Alternate Product(s):
.1 Leviton equivalent.

2.4 SPECIAL WIRING DEVICES

.1 Horsepower rated toggle switches, voltage, amperage, NEMA enclosure rating to suit. Padlockable Hubbell, series to suit.

.2 Portable equipment (fan, pump, welding) outlet to be Hubbell Circuit Lock Series. Size, number of poles and pin orientation to suit. Provide twice the matching plug quantity to the outlet quantity.

.3 Use Hubbell Acceptor ® in hazardous locations.

2.5 COVER PLATES

.1 Provide cover plates for all wiring devices.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel 1 mm thick cover plates, for all wiring devices mounted in a flush-mounted outlet box.

.4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates complete with gaskets for duplex receptacles as indicated.

.6 Blank plates - finish to match other plates in area, for boxes without wiring devices.

.7 OCAL cover plates for OCAL boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Switches:
- .1 Install single throw switches with handle in "UP" position when switch closed.
- .2 Install switches in gang type outlet box when more than one switch is shown in one location.

.2 Receptacles:
- .1 Install receptacles vertically in gang type outlet box when more than one receptacle is shown in one location.
- .2 Install straight blade receptacle with ground pin up.
- .3 Provide “controlled” receptacles only where explicitly indicated. All other receptacles to be “non-controlled” per Article 2.3.1.

.3 Cover Plates:
- .1 Protect stainless steel cover plate finish with paper or plastic film until all painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use flush type cover plates on surface-mounted boxes.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CAN/CSA-C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  .2 CSA C22.2 No. 65, Wire Connectors.

.2 National Electrical Manufacturers Association (NEMA).

1.2 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to NEMA to consist of:
  .1 Connector body and stud clamp for stranded copper conductors.
  .2 Clamp for stranded copper conductors.
  .3 Stud clamp bolts.
  .4 Bolts for copper conductors.
  .5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable or flexible conduit, as required to: CAN/CSA-C22.2 No.18.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:
  .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE

.1 The Lighting Fixture Schedule on the drawings lists the only Acceptable Manufacturers/ Suppliers as defined in Division 1.

1.2 PRODUCT DATA

.1 Submit photometric data prepared by independent testing laboratory for all fixtures for review by Consultant.

1.3 SHOP DRAWINGS

.1 Shop drawings in accordance with Division 1.

1.4 SEISMIC RESTRAINT

.1 Installations in this section are subject to support and anchorage requirements, as directed by the seismic restraint Consultant retained by Contractor.

1.5 MAINTENANCE MATERIALS

.1 Provide at least 5%, minimum three (3), spare lamps in original containers for all lamps, types and sizes used on project. Turn over to Owner and obtain receipt.

1.6 GUARANTEE FOR LAMPS AND BALLASTS

.1 Replace:

.1 All incandescent and tungsten halogen lamps burnt out within three (3) months of substantial completion.

.2 All fluorescent or high pressure sodium lamps burnt out within 12 months of substantial completion.

.3 All fluorescent ballasts that fail within 12 months of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIAL STANDARDS

.1 Incandescent and electric-discharge fixtures to CSA C22.2 No. 9.

.2 Socket screw-shell lampholders to CSA C22.2 No. 43.

.3 Electric discharge lampholders and ballasts to CSA C22.2 No. 74.

.4 Incandescent lamps to CSA C22.2 No. 84.

.5 Tungsten halogen lamps to CSC C22.2 No. 84.

.6 Fluorescent and HID lamps to ANSI C78.

.7 Ballasts to CSA C22.2 No. 74.

.8 Radio interference suppressors to CSA C22.2 No. 8.

.9 Exit lights to CSA C22.2 No. 9.

.10 LED lighting to IES LM-79 and IES LM-80.

.11 C22.2 No 14 – Industrial Control Equipment.

.12 C22.2 No. 223 – Power Supplies for ELV Class 2 Outputs.

2.2 FLUORESCENT BALLASTS

.1 Suitable for:
- .1 T5 and/or T5H0 lamps.
- .2 Power factor to be not less than 95% lagging or leading.
- .3 Nominal circuit voltage 120 V.
- .4 "A" sound rating with automatic reset thermal protection.
- .5 Maintain constant light output at -25%, +20% of rated voltage.
- .6 Total harmonic current distortion to be less than 10% at maximum ballast-lamp rating.
- .7 Crest factor to be maintained below 1.4.
- .8 Suitable for starting down to 10°C.
- .9 Warranty - minimum three (3) years.
- .10 Programmed rapid start.

.2 Contractor is responsible to coordinate ballast to lamp and ballast to control (dimmer/occupancy/daylight) sensor.

2.3 FLUORESCENT BALLAST ACCEPTABLE MANUFACTURERS/SUPPLIERS

.1 Acceptable Manufacturers/Suppliers are:
- .1 Osram.
- .2 Standard.
- .3 Alliance.

2.4 LED LAMPS

.1 Optical Assemblies: LEDs shall be provided with discreet optical elements to provide IESNA Type II, III, IV or V distributions. Additional distributions for spill light control shall be utilized when light trespass must be mitigated. All optical assemblies will be mounted parallel to the ground, aimed in the same direction and shall provide the same optical pattern such that catastrophic failures of

individual LEDs will not constitute a loss in the distribution pattern. The luminaire shall have minimum efficacy of 85 lm/W as reported by an LM-79 report for each luminaire wattage and photometric distribution considered.

.2 All photometric data will be measured by the IESNA LM-79-08 standard and formatted per IESNA LM-63-02 as an electronic .ies file.

.3 Lumen depreciation shall not decrease by more than 30% over the expected operating life of a minimum of 80,000 hours @ 25°C. The measurements shall be calibrated to standard photopic calibrations. The LED device manufacturer shall have tested the lumen maintenance characteristics of the LED package in accordance with the guidelines of IESNA LM-80-08 “Approved Method for Lumen Maintenance Testing of LED Light Sources”. A copy of the manufacturer’s LM-80 reports shall be submitted for review, accompanied by lumen depreciation estimates for 10, 15 and 25 degrees Celsius luminaire ambient operating temperatures.

.4 Light Colour/Quality: The luminaire shall have a correlated colour temperature (CCT) range or 4,000 K to 4,500 K. The colour rendition index (CRI) shall be 70 or greater. Binning of LEDs shall conform to ANSI/G.NEMA SSL 3-2010.

.5 Backlight-Uplight-Glare: The luminaire shall not allow more than 10 percent of the rated lumens to project above 80 degrees from vertical. The luminaire shall not allow more than 2.5 percent of the rated lumens to project above 90 degrees from vertical. Backlight and Glare ratings as per fixture schedule and calculated per IESNA TM-15.

2.5 LED DRIVERS

.1 Power Consumption: maximum power consumption allowed for the luminaire shall be determined by application. The luminaire shall not consume power in the off state.

.2 Operation Voltage: the luminaire shall operate from a 60 Hz AC line over a voltage ranging from 108 Vac to 305 Vac. The fluctuations of line voltage shall have no visible effect on the luminous output.

.3 Power Factor: the luminaire shall have a power factor of 0.90 or greater.

.4 THD: total harmonic distortion (current and voltage) induced into an AC power line by a luminair shall not exceed 20 percent over entire load range 0 – 100%.

.5 Surge Suppression: the luminaire on-board circuitry shall include surge protection devices (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes and other interference. The SPD shall protect the luminaire from damage and failure for common mode transient peak voltages up to 10 kV (minimum) and transient peak current up to 5 Ka (minimum). SPD performance shall be tested per the procedures in ANSI/IEEE C62.41-1992 (or current edition) for Category C (standard). The SPD shall fail in such a way as the luminaire will no longer operate. The SPD shall be field replaceable.

.6 The power supply driver enclosure should be sealed to protect against the entry of dust and water. This area should be sealed to minimum Ingress Protection level 65 (IP65).

.7 RF Interference: LED drivers must meet Class A emission limits referred in Federal Communications Commission 9FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

.8 The total current harmonic distortion of power supply drive induced into an AC power line shall not exceed 20%.

2.6 CHAIRS FOR CHAIN HUNG FIXTURES

.1 Provide 304 stainless steel chairs for all chain hung fixtures. Size chains to suit. Refer to Section 16010 for seismic requirements.

PART 3 - EXECUTION

3.1 FIXTURE INSTALLATION

.1 Install lighting fixtures in acceptable manner for type of fixture and in accordance with manufacturer's installation instructions, using fixture studs or other recommended methods.

.2 Align fixtures shown in continuous lines or rows so that they appear as straight lines, unless otherwise indicated.

.3 Do not mount fixtures above pipes, ducts or equipment. Check layouts of work by other trades on project and plan cooperatively with others to avoid conflict. Provide longer hangers to clear obstructions, in event of unavoidably tight locations.

.4 Use ball and socket aligners on fixtures suspended from sloped ceiling to allow rods to hang vertically.

.5 Determine proper fixture accessories and mounting method for installation of recessed fixtures based on ceiling construction. Leave at least 12 mm air space between recessed incandescent fixture enclosures and combustible material other than that to which they are attached. Provide stick-on foam gaskets between frame of recessed fixture and ceiling to prevent light leakage, if any occurs.

3.2 FIXTURE SUPPORT

.1 Support fluorescent fixtures recessed in T-bar ceilings independently from building structure. When installed, fixture to lie on T-bar grid system but should grid system fail, fixture must not drop more than 12 mm. Use galvanized coil chain with 36 mm links for support.

3.3 EMERGENCY AND EXIT LIGHT INSTALLATION

.1 Install unit equipment and remote-mounted fixtures as indicated.

.2 Cut and recap cords to remove surplus.

.3 Direct heads to illuminate path of exit route.

.4 Size wire to limit voltage drop to 3%.

3.4 EMERGENCY AND EXIT LIGHTING TESTING

.1 Test system as per manufacturer’s recommendations under battery load for minimum 30 minutes.

.2 Repeat test 24 hours later for 30 minutes to confirm battery charger.

.3 All tests to be witnessed by building official.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

.1 Provide MCCs as specified.

.2 Provide all wiring.

1.2 SEISMIC RESTRAINT

.1 Installations in this section are subject to support and anchorage requirements, as directed by the seismic restraint Engineer retained by Contractor. Refer to Section 16010.

1.3 REFERENCE

.1 Single line diagrams Motor Starter Schematics and Motor Starter and Control List.

.2 Section 16801.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

.1 Not Applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install new MCC sections and demolish existing MCC compartment where indicated.

.2 Provide new MCC feeders.

.3 Provide new branch load feeders to new loads and to existing loads that are designated to remain. Remove all existing branch load feeders from existing MCCs being removed.

.4 Install new control devices make power and control connections as shown.

3.2 WIRING

.1 Provide all necessary 120 VAC wiring and signal wiring as shown.

.2 Provide all control wiring under 120 VAC as shown.

.3 Label phasing in all new starters and contactors: Phase A, Phase B, Phase C.

3.3 INITIAL START-UP

.1 Coordinate schedule with supplier of MCC.

3.4 TESTS

.1 Conduct the following tests:

- .1 Feeder insulation megger tests.
- .2 Ground bonding system continuity and resistance measurement tests.
- .3 Verify voltage and current on starting and running cycles on each phase of supply circuit and for each load.
- .4 Operate switches and controls to verify correct functioning in presence of Owner and Consultant.
- .5 Other tests outlined in Section 16031 and as required by the MCC manufacturer.
- .6 Submit written test results to Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE

.1 Single line diagrams and Motor Starter Control List.

.2 Section 16800 - 600 Volt MCC – Installation.

.3 Section 16812 - Variable Frequency Drives (in New MCC).

.4 Section 17051 - Control Panel Details.

1.2 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data for each type and style of starter.

1.3 SHOP DRAWINGS

.1 Submit shop drawings of MCC including a complete wiring diagram in PDF format, trip curves for each type of fuse, circuit breaker and overload to Consultant for approval.

.2 Shop drawings must indicate short circuit rating (interrupting and withstand) of each breaker, fusible switch and starter.

.3 Shop drawings to indicate short circuit bus bracing.

.4 Shop drawings to indicate VA requirements (inrush and sealed) at 120 VAC/60HZ for each coil unit.

.5 Include a copy of PC software for communication to each type of device complete with cables.

.6 VFD Harmonic profiles with and without filters.

.7 Submit shop drawings per Division 1.

PART 2 - PRODUCTS

2.1 MATERIAL STANDARDS

.1 Provide starters and auxiliary control devices to CSA C22.2 No. 14 and EEMAC E14 No. 1.

.2 Control transformers to CSA C22.2 No. 66.

.3 All starters to be NEMA-rated for HP and AMP.

2.2 MCC

.1 New CSA approved MCCs to be rated at rated amperage 50℃ rise/600 VAC/3 phase 4 wire/60HZ

with minimum 18 KAIC bracing, as indicated.

.2 Class I, Type B wiring, Type 1-A gasketted enclosure.

.3 Constructed with 14-gauge steel minimum frame and welded corner channels; side, back, roof and covers of 14 gauge steel.

.4 Tin-plated copper bussing.

.5 Captive horizontal splice bars with self-contained nuts and hardware.

.6 Grounding in each section.

.7 Quarter-turn fasteners on unit and wireway doors, all hinged.

.8 A full-depth vertical wireway.

.9 Unit door hinge pins easily removed with a screwdriver for general maintenance.

.10 Each unit is fully compartmentalized, having solid side, back, and bottom plates.

.11 A hinged, unit bottom plate for more wiring space.

.12 Leveling notches in the base channel provide a means of aligning the section during installation.

.13 Main Lugs for incoming feeder to be copper.

.14 MCC shall contain individual units as per drawings.

.15 Supply all fuses, type to be suitable for the application.

.16 Starter to have defeatable mechanically interlocked equipment door, to prevent opening when handle in "on" position.

.17 Copy of wiring and schematic diagram inside starter enclosure in readily visible location and permanently secured.

.18 All enclosure parts to be phosphatized and electrostatic powder paint coat.

.19 Provide one copy of software and one USB cable for each type of device for each of the MCCs.

.20 Provide screw-type terminal blocks for all internal component wiring terminations within the MCC and for all incoming field wiring, including network communications wiring. Only one wire under each screw is permitted, unless otherwise approved by Consultant. Provide 20% spare terminals for future use.

.21 Switches and indicators and other devices as per Section 17051.

2.3 FIELDBUS COMMUNICATIONS

.1 All starters, VFD and overload relays supplied under this contract are to be intelligent devices capable of two way communication.

.2 Communication is to be Ethernet/IP. Fully compatible with specified Rockwell CompactLogix/ControlLogix PLCs.

.3 For the Shop Drawing stage, the MCC supplier is to provide wiring details specific to selected communication protocol. Drawings are to be project specific.

2.4 ETHERNET SWITCHES

.1 Provide managed Ethernet switch(es) as indicated. Each switch is to be equal to (or better than) the Allen-Bradley Stratix 5200 Series c/w full software. Provide sufficient number of switches for the number of ports required in the MCC. Provide a minimum of four (4) spare ports in the switch.

.2 Each switch is to be powered via a 24 VDC power supply system. 24 VDC power supply system to be provided by the MCC supplier and located inside the MCC.

.3 Full mounted starters (or equipment) can share an Ethernet switch. This switch may reside in a separate section from the full mounted equipment.

2.5 24 VDC POWER SUPPLY

.1 24 VDC power supply system for the Ethernet switches inside the MCC.

.2 Power supplies to be fed from external 120 VAC (UPS) power. Provide circuit breakers, terminal blocks, and other appurtenances required.

.3 Provide an alarm dry contact on the power supply for external monitoring by a PLC.

2.6 ETHERNET BACKBONE CABLING

.1 Provide Category 5e/6 Ethernet cabling throughout the MCC for connection to all the components that communicate on Ethernet.

.2 Cable lengths between switches not to exceed 90m.

.3 Cable to meet the following minimum requirements:

- .1 Foil and braided shield, PVC, eight conductors (4-pair).
- .2 600V PVC cable designed to support high voltage applications.
- .3 On-machine rated cable for use in a cable tray shared with high voltage power cables.
- .4 RJ 45 insulation displacement connector available for field terminations.
- .5 Wide thermal operating range of -20°C to 80°C.
- .6 CSA/cUL listing.

.4 Star topology.

.5 Provide Ethernet adapters, as required for Ethernet cable connections.

2.7 VOLTAGE SEPARATION AND EMI

.1 MCC manufacturer to ensure that the Ethernet cabling is fully protected and isolated from the 600VAC and other power inside the MCC. Run Ethernet cabling in wiring ways and via other means for protection.

.2 Ensure Ethernet cabling is fully protected and isolated from EMI, particularly from VFDs.

2.8 EQUIPMENT IDENTIFICATION

.1 Provide a lamacoid nameplate for each starter and disconnect unit with description of load.

.2 Lamacoid nameplates to be 6 mm black letters on white background, screwed onto covers.

2.9 MANUAL OPERATOR INTERFACE (PUSHBUTTONS, PILOT LIGHTS, ETC.)

.1 Each pilot light to meet the following:
- .1 Factory assembled.
- .2 Push-to-test.
- .3 120VAC LED.
- .4 NEMA 12.
- .5 Colour as indicated.
- .6 30 mm diameter.
- .7 Heavy industrial rated.
- .8 Finger-safe guards.
- .9 CSA certified.
- .10 Acceptable product:
  - .1 Allen-Bradley 800TC series, or approved equivalent.
- .11 Pilot light colours:
  - .1 Amber: Fault.
  - .2 Red: Stopped.
  - .3 Green: Running.
  - .4 Colours not final until shop drawings have been reviewed.

.2 Each 3-position selector switch to meet the following:
- .1 Factory assembled.
- .2 Finger-safe guards.
- .3 Non-illuminated.
- .4 Standard knob with white insert.
- .5 Maintained Operator function.
- .6 Contact rating of 600VAC and 600VDC.
- .7 30 mm diameter.
- .8 NEMA 12.
- .9 Number of contacts as required for the control circuit. Capable of accepting additional contact blocks.
- .10 Heavy industrial rated.
- .11 CSA certified.

.12 Acceptable product:
.1 Allen-Bradley 800TC series, or approved equivalent.

.3 Each potentiometer to meet the following:
.1 Factory assembled.
.2 Finger-safe guards.
.3 Non-illuminated.
.4 Standard knob with white insert.
.5 30 mm diameter.
.6 NEMA 12.
.7 Resistance rating to suit.
.8 Heavy industrial rated.
.9 CSA certified.
.10 Acceptable product:
.1 Allen-Bradley 800TC series, or approved equivalent.

.4 Each pushbutton to meet the following:
.1 Factory assembled.
.2 Finger-safe guards.
.3 Non-illuminated.
.4 Colour as indicated.
.5 Contact rating of 600VAC and 600VDC.
.6 30 mm diameter.
.7 NEMA 12.
.8 Number of contacts as required for the control circuit. Capable of accepting additional contact blocks.
.9 Heavy industrial rated.
.10 Extended head for stop operations, flush head otherwise.
.11 CSA certified.
.12 Acceptable product:
.1 Allen-Bradley 800TC series, or approved equivalent.

.5 Each legend plate shall meet the following:
.1 Provide a legend plate for each of the following:
.1 Pilot light.
.2 Selector switch.
.3 Potentiometer.
.4 Pushbutton.
.5 Emergency stop.
.2 Aluminum.
.3 NEMA 12.
.4 Engraved by the manufacturer.
.5 Gray in colour.
.6 Acceptable product:
.1 Allen-Bradley 800T standard or jumbo legend plate, or approved equivalent.

.6 Each AC Hour meter to meet the following:
.1 Records up to 99,999 hours; automatically resets to zero.

.2 120VAC, 60Hz.
.3 Accuracy of at least ± 0.02%.
.4 Screw termination.
.5 Glass lens.
.6 CSA certified.
.7 Acceptable manufacturer:
.1 Hobbs, or approved equivalent.

2.10 MCC STARTERS

.1 NEMA rated FVNR starters for HP and AMPS, with 120 VAC/60HZ coils complete with surge suppressor.

.2 Series C or better magnetic moulded case 3-phase circuit breaker with 18 KA sym. rms interrupting capacity.

.3 Self-protected fully programmable electronic 1-NC starter. 1-NC spare auxiliary contacts on contactor, 1-NO 1-NC on switch and 1-NO 1-NC trip indicating contacts.

.4 Network Communications capable of:
.1 Monitoring individual currents.
.2 Monitoring faults.
.3 Monitoring auxiliary devices.
.4 Monitoring status.
.5 Operating starter.
.6 Trip reset.

.5 Hand-Off-Auto, 3-position selector switch:
.1 Hand = Motor Runs.
.2 Off = Motor Stops.
.3 Auto = Motor controlled by PLC via Network communications. Network communications advise PLC that switch is in Auto.

.6 Pilot Lights, individual units, heavy duty, LED cluster type bulbs, push to test:
.1 Running (Green).
.2 Stopped (Red).
.3 Tripped (Amber).

.7 Fault reset via local reset button as well as over the Network Communications.

.8 Each starter to be wired to facilitate local manual control at the motor. Refer to Section 17051.

2.11 MCC FEEDER UNITS

.1 Series C thermal-magnetic moulded case 3 phase circuit breaker with 18 KA sym. rms interrupting capacity or disconnect and fuses as indicated.

.2 1-NO and 1-NC spare auxiliary contacts on switch.

2.12 MCC MAIN

.1 Reserved.

2.13 SPD

.1 Reserved.

2.14 POWER MONITOR

.1 Reserved.

2.15 VFD

.1 Refer to Section 16812.

2.16 MANUAL TRANSFER SWITCH

.1 Reserved.

2.17 SPARE FUSES

.1 For three phase circuits provide six (6) spare fuses of each type and size.

.2 For single phase circuits provide four (4) spare fuses of each type and size including control circuits.

2.18 ACCEPTABLE MCC

.1 Acceptable product:
  .1 Existing MCC manufacturer.

PART 3 – EXECUTION

3.1 INITIAL START-UP

.1 Before placing motor on load:

.2 Ensure that variable frequency drives are properly sized and wired into circuit.
  .1 Check all circuit protective devices.
  .2 Ensure that external control wiring has been verified. Record any changes on control diagrams.
  .3 Perform phase rotation check.

.3 Refer to General Conditions for Reporting procedures.

3.2 ETHERNET NETWORK COMMISSIONING

.1 MCC manufacturer to fully test the Ethernet network to ensure conformance with ODVA Ethernet/IP requirements.

.2 Tests to include, traffic, analysis, including collisions, bandwidth issues, cable length issues, packet losses, etc. Provide test reports upon completion of commissioning.

3.3 TRAINING

.1 Refer to Division 1.

.2 Provide one (1) four (4) hour training sessions onsite. Training sessions to be at least 2 weeks apart. These one (1) training sessions shall be separate from any onsite commissioning and startup sessions. The training session to include the following:

- .1 Operation of the starters and devices on the MCC.
- .2 The Operator interface for the MCC, including accessing the different screens on all the displays on the MCC, including the VFDs.
- .3 Operation of the equipment via the Operator interfaces provided on the MCC, including starting and stopping motors as well as changing the speed and resetting alarms and breakers.
- .4 Maintenance requirements of the equipment, per the manufacturer's recommendations.
- .5 Other items per the manufacturer's recommendation as well as per the Owner's request. Provide a training agenda to the Owner at least two (2) weeks prior to scheduling, for their review and feedback. The equipment O&M manuals shall be provided to the Owner at least two weeks prior to the training session.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Refer to motor starter and control list on drawings, to establish materials supplied under other Divisions for installation and/or wiring in this Division.

1.2 PRODUCT DATA

.1 Check reviewed mechanical shop drawings before roughing-in electrical service.

.2 Check single line diagrams submitted with mechanical shop drawings or product data to ensure that functions of each mechanical system can be performed.

.3 Where mechanical equipment submitted for review requires service or controls other than specified, advise Consultant.

.4 Coordinate the characteristics and the integration of the variable frequency drive units with Division 15 and the manufacturer of the drive motor equipment. Obtain shop drawings and motor nameplate data from General Contractor.

1.3 AS-CONSTRUCTED DRAWINGS

.1 Show interconnection of mechanical and electrical components on As-Constructed Drawings.

1.4 MOTOR VOLTAGES

.1 Motor voltages characteristics are generally as follows:
- .1 400 W and smaller: 120 V, 1 phase, 60 Hz.
- .2 600 W 1/2 hp and larger: 600 V, 3 phase, 60 Hz.
- .3 Refer to motor starter list for exceptions to above.

1.5 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data for each type and style of starter.

1.6 SHOP DRAWINGS

.1 As per Division 1, submit shop drawings, including a complete wiring diagram and faceplate layout in PDF format, trip curves for each type of overload to Consultant for approval.

PART 2 - PRODUCTS

2.1 MANUAL MOTOR STARTERS

.1 Provides overload protection as well as manual on/off control for small motors.

.2 Number of poles to suit. Provide two pole as required for controls, as indicated.

.3 Horsepower, voltage and phase as indicated.

.4 “Quick-make” and “quick-break” mechanism.

.5 NEMA rating as indicated.

.6 Rated for industrial applications.

.7 Red neon pilot light. Pilot light energized when motor is running.

.8 Terminals rated for intended wire size.

.9 Mounting style as indicated.

.10 Toggle, padlockable handle. Padlockable in the OFF position.

.11 Provide plug-in heater element, keyed to ensure proper positioning. Heater to have adjustable knob to allow setting of plus or minus ten percent of nominal heater rating.

.12 For each manual motor starter provide three (3) spare thermal units in original packing to Owner.

2.2 ACROSS-THE-LINE MAGNETIC MOTOR STARTERS

.1 Across-the-line magnetic motor starters of size, type and W, hp or kW rating as indicated.

.2 Combination across-the-line magnetic motor starters with moulded case circuit breaker.

.3 CSA Type 4 ANSI 61 Grey enclosure for all starters except where indicated otherwise. Refer to Section 17051 for requirements of enclosures.

.4 Power and control terminals.

.5 Half-size starters not acceptable.

.6 All starters to be IEC rated.

2.3 STARTER COMPONENTS

.1 Each starter to have motor overload protective device in each phase, manually reset from outside of enclosure.

.2 All starters to have defeatable mechanically interlocked equipment door, to prevent opening when handle in "on" position.

.3 Copy of wiring and schematic diagram inside starter enclosure in readily visible location and permanently secured.

2.4 AUXILIARY CONTROL DEVICES

.1 As per Section 17051.

.2 Control transformer, 600 V, 60 Hz primary, 120 V single phase secondary, VA rating to suit loading of controls plus 20% margin, fused on secondary side.

.3 2-NO and 2-NC spare auxiliary contacts in addition to maintained auxiliary contact and those shown.

.4 Hand-Off-Auto selector switch oil tight, heavy duty type labelled as indicated with 3-N/O, 3-N/C contacts. Type H03.

.5 Pilot lights oil tight, heavy duty, LED type. Lens colour Red to indicate equipment stopped, Green for running and Amber for faults. Type O01

.6 Momentary contact fault reset push buttons. Colour to be blue. Type H01.

.7 Magnetic control relays, operating coil voltage as indicated. Contacts interchangeable from N/O to N/C.

2.5 FINISH FOR STARTERS

.1 Finish interior and exterior in accordance with Section 16010.

2.6 EQUIPMENT IDENTIFICATION

.1 Refer to Section 16010.

2.7 MANUFACTURERS

.1 All motor control equipment to be product of one manufacturer.

.2 Acceptable manufacturers:

- .1 Rockwell Automation
- .2 Eaton
- .3 ABB
- .4 Square D.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install enclosed starters and auxiliary control devices, make power and control connections as indicated.

3.2 WIRING

.1 Provide all necessary wiring for mechanical controls, panels, damper motors, thermostats, etc. as detailed in Division 15. Only principal connections are shown on electrical drawings.

.2 Identify each wire, and terminal for external connections, with permanent number marking identical to diagram.

3.3 INITIAL START-UP

.1 Before placing motor on load:
- .1 Ensure that overload relays are properly sized and wired into circuit.
- .2 Check all circuit protective devices.
- .3 Ensure that external control wiring has been verified. Record any changes on control diagrams.
- .4 Division supplying motor must be present.

3.4 TESTS

.1 Conduct tests in accordance with Section 16010.

.2 Verify voltage and current on starting and running cycles on each phase of supply circuit.

.3 Check rotation of motors.

.4 Operate switches and controls to verify correct functioning in conjunction with Division 15.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 NEMA MG1, Part 30.

.2 NEMA MG1, Part 31.

.3 IEEE – 819.

.4 CSA 22.2.

.5 UL 508c.

.6 EMC emissions-EN50081-2, EN61800-3.

.7 Section 16801, MCCs.

1.2 INTENT OF SECTION

.1 Provide all labour, equipment, material, supervision and design, testing, supply, installation and commissioning services required for complete variable frequency AC induction motor drive (VFD) systems.

.2 Confirm the application of each drive and provide variable torque units to suit the specific requirements of each drive.

1.3 SUBMITTALS

.1 Shop Drawings as per Division 1:
- .1 Submit shop drawings to Consultant for approval, per Division 1.
- .2 Include the following:
  - .1 Dimensioned outline drawing.
  - .2 Schematic diagram.
  - .3 Component list, including makes and models.
  - .4 Component heat generation and cabinet heating/cooling.
  - .5 Power and control connection diagram(s).
  - .6 Table of Programmable Parameters and VFD software and one Programming Cable.
  - .7 AMP and HP full load ratings, short circuit input withstand rating.
  - .8 The harmonic current shall not exceed IEEE-519 recommendations.
  - .9 Performance data and rating of input reactor, inductance, and resistance values.
  - .10 Performance data on EMC emissions RFI filter.
  - .11 Harmonic filter complete with contractor cutout.
- .3 Provide two (2) copies of VFD software (latest MS Windows operating system), and two (2) programming interface cables.

.2 Operation and Maintenance Manual:
- .1 Include updated Table of Programmable Parameters reflecting site calibration settings and adjustments in electronic and paper format.

1.4 ON-SITE START-UP

.1 See General Conditions.

1.5 COORDINATION WITH DIVISION 15

.1 Coordinate the characteristics and the integration of the variable frequency drive units with the manufacturer of the drive motor equipment. Obtain shop drawings and motor nameplate data from General Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Provide a continuous duty, solid state, variable frequency drive (VFD) system suitable for operation on the plant electrical power system and controlled locally and remotely via hardwired logic and PLC I/O as indicated.

.2 Each VFD system to consist of, but not be limited to, the following major components:
- .1 Enclosure.
- .2 Padlockable main disconnect and fusing.
- .3 Line reactor.
- .4 Input RFI filter.
- .5 VFD-IGBT type.
- .6 Load reactor/harmonic filter.
- .7 Program and display interface.
- .8 Hand-off-auto.
- .9 Speed control (manual mode).
- .10 Run, stop, fault indicators.
- .11 Run time meter.
- .12 Provide optional Ethernet communication module.

.3 All VFD motors shall be inverter duty to NEMA MG1, Part 31.

2.2 ENCLOSURE

.1 Mounted inside MCC, as indicated.

.2 Provide the following Operator Interface on the door of the MCC cell:
- .1 AC hour meter.
- .2 Fault pilot light.
- .3 Stopped pilot light.
- .4 Running pilot light.
- .5 Fault reset pushbutton.
- .6 3-position Hand-Off-Auto selector switch.

.7 Speed Potentiometer (0% to 100%).

.8 Human Interface Module (HIM).

.3 Refer to Section 16801 for requirements of the Operator Interface devices.

.4 Provide adequate ventilation in cabinet to suit heating load from all components including VFD, line reactor, harmonic filters, control transformers, and power supplies. Provide itemized heat load as part of the shop drawings. Include feedback control for ventilation fan, for example via thermostat to extend the operating life of the ventilation fan. Ventilation fan to run when the VFD is running and when the cabinet interior temperature is equal or above cooling thermostat setpoint. Ventilation fan to remain on after a stop until the VFD cools downs.

.5 Provide terminal blocks and Panduit wire ducts to keep installation neat. Label all wires and terminals. Assemble panels in such a way that the power feeders are kept clear of the analog control signals (minimum of 150 mm clearance).

.6 Input 600 VAC fusible switch with fuses shall be provided.

2.3 INPUT LINE REACTOR

.1 Provide input line reactor to suit. Refer to drawings.

.2 The manufacturer to provide harmonic filtering to meet or exceed IEEE 519 standards when applied to the major 600v bus (with up to 3 VFDs running concurrently). Filters may include reactive capacitors provided that they are isolated from the main bus when the VFD is offline and, does not force the main bus into leading power factor at any VFD load condition when running.

2.4 LOAD SIDE LINE REACTORS

.1 The contractor and VFD manufacturer shall coordinate with the pump/motor manufacturer prior to submitting shop drawings and provide dv/dt filtering with acceptable voltage drop and harmonic performance to the motor manufacturers acceptance for proper operating conditions (including thermal rise) of the motor at all operational duty points. This can be accomplished by any combination of load reactors and/or dV/dt filters at the drive. Shop drawings shall clearly indicate that this pre-coordination /acceptance has been carried out by all parties in advance.

2.5 VFD

.1 The VFD shall be rated as indicated 600 VAC, 60 Hz with selectable motor control; sensorless vector with full tuning; standard V/Hz with custom capability and vector control.

.2 The VFDs shall be of the Pulse Width Modulated (PWM 6 or 12 pulse) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Insulated gate bipolar transistors (IGBT) shall be used in the inverter section.

.3 The VFDs shall have efficiency that exceeds 97% at 100% speed and load. The load efficiency shall exceed 80% at 10% speed and load.

.4 The VFDs shall maintain the line side displacement power factor at no less than 0.90, regardless of

speed and load.

.5 Normal duty drives shall have a 110% overload rating for one (1) minute when applied to variable torque loads and 150% overload rating for one (1) minute when applied to constant torque loads.

.6 Heavy-duty drives shall have a 150% overload rating for one (1) minute when applied to variable torque loads and 200% overload rating for one (1) minute when applied to constant torque loads.

.7 The VFDs shall be capable of operating any NEMA B squirrel cage induction motor, with an SF=1.15, regardless of manufacturer, with a load rating equivalent to the capacity of the VFDs.

.8 The VFDs shall be able to start into a spinning motor. The VFDs shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the VFDs shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.

.9 Standard operating conditions shall be:

- .1 Incoming Power: Three-phase, 600 V (+10% to -15%) and 47 to 63 hertz.
- .2 Frequency stability of +/-0.5% for 24 hours with voltage regulation of +/-2% of maximum rated output voltage.
- .3 Motor slip dependent speed regulation of +/-0.5%.
- .4 Logic Control Ride-Thru, 0.5 seconds minimum, 2 seconds typical.
- .5 Insensitive to input line rotation.
- .6 Humidity: 0 to 95% (non-condensing and non-corrosive).
- .7 Altitude: 0 to 3,300 feet above sea level.
- .8 Ambient operating Temperature: 0 to 40 C (NEMA 1).
- .9 Storage Temperature: -40 to 60 C.
- .10 Starting Torque: 150% for constant torque loads and 110% for variable torque loads.
- .11 Output frequency: 0 to 400 HZ.
- .12 Frequency resolution: 0.01 HZ.
- .13 Switching frequency: 2 to 10 KHz. Drive rating based on 4 kHz.
- .14 Acceleration time: 0.1 to 20 seconds.
- .15 Deceleration time: 0.1 to 20 seconds.
- .16 Vibration: 0.152 mm displacement, 1G peak. Vibration to IEC721-3-3.
- .17 Shock: 15G peak for 11 mg duration (+/- 1.0 ms). Shock to IEC68-2-27.
- .18 Braking Torque: 30% Tn with regeneration limit circuitry.

2.6 COMMUNICATIONS

.1 Compatible with starters.

.2 Communication capable of:

- .1 Monitoring individual phase currents.
- .2 Monitoring faults.
- .3 Monitoring auxiliary devices.
- .4 Monitoring status.
- .5 Setting O/L and trip setters.
- .6 Configuring drive parameters.
- .7 Operating VFD.

.8 Trip reset, fault clear.

.3 VFD to include Ethernet communication module, as indicated.

2.7 VFD OPERATING CONTROLS

.1 HOA via selector switch.

.2 Manual: HIM, potentiometer.

.3 Remote (Auto): PLC controlled on/off, direction (if used) and speed via hardwired logic, PLC I/O or Network communication as indicated.

.4 E-STOP (emergency stop): via keypad regardless of operating mode.

.5 Pilot Lights:
- .1 Run (Green)
- .2 Stopped (Red)
- .3 Fault (Amber)

.6 Run time meter: 0 to 100,000 hrs.

.7 For local control stations (LOC), the VFDs to be configured for start/stop operation via Hand-Off-Auto switches, which shall be located remotely from the VFD, as indicated.

2.8 VFD CONTROL FUNCTIONS

.1 All VFD programmable parameters shall be adjustable from a digital operator keypad located on the front door of the VFD or via Microsoft Windows software. Parameters shall include:
- .1 Programmable speed command (keypad, remote).
- .2 Programmable start command (keypad, remote).
- .3 Forward or reverse start, stop and digital speed control.
- .4 Programmable maximum and minimum frequency limits.
- .5 Programmable acceleration and deceleration times (2 each).
- .6 Programmable critical frequency avoidance lockout zones.
- .7 Programmable electronic overload and torque limits.
- .8 Programmable multiple attempt restart.
- .9 Programmable preset speeds.
- .10 Programmable "Catch a Spinning Motor" function.
- .11 Programmable output digital relay (2).
- .12 Programmable output analog signal.
- .13 Programmable DC Injection Braking Time.
- .14 Programmable PI process control.
- .15 Programmable digital potentiometer.

.2 Provide minimum 2 programming cables and no less than 1 cable per 3 VFDs.

.3 Input Interfaces:

.1 Process control speed reference interface to receive either a 0-10 Vdc, 4-20 mA dc or speed potentiometer signal.
.2 Remote mode start and stop contacts.
.3 Remote forward/reverse contacts.
.4 Remote preset speed contacts.
.5 Remote external trip contact.
.6 Remote reset contact.
.7 Remote jog contact.
.8 Remote analog speed control

.4 Output Interfaces:
.1 Programmable digital relays N/O and N/C contacts. Number of contacts as indicated.
.2 Form C contact to indicate protective function trip.
.3 Two (2) programmable analog output signals.

.5 PLC I/O Interfaces:
.1 Provide the PLC I/O interface as indicated.

2.9 VFD DISPLAY

.1 Monitoring and Display: Have a 2-line, 16-character display, indicating monitored functions as described in the following:
.1 Output current.
.2 Output frequency.
.3 Motor rpm.
.4 Output voltage.
.5 Power.
.6 Load.
.7 Elapsed time.
.8 Trip cause.
.9 Active alarms

2.10 VFD PROTECTIVE FUNCTIONS

.1 Overcurrent protection.

.2 Overvoltage protection.

.3 Undervoltage protection.

.4 Phase loss protection.

.5 Over-temperature protection.

.6 Ground fault protection.

.7 Adjustable current limit.

.8 Line-to-line and line-to-ground output short-circuit protection.

.9 DC injection braking.

.10 Motor winding over-temperature sensor input.

.11 Overload capability shall be 150% full capacity amperes for 60 seconds.

2.11 INPUT RFI FILTER

.1 Mount inside the enclosure.

.2 To meet EN50128, EN61800-3.

2.12 WIRING

.1 Provide all internal wiring, copper conductor, stranded, 600 V rated, 75℃ minimum.

.2 Each wire is to be uniquely identified by a wire marker on either end. Wire identification to correspond to wire numbers on the schematic and control diagrams. Colour coding is not acceptable.

.3 Provide modular terminal blocks for all external control wiring connections, 600 V, 25 A rating, DIN rail mounted. Label each terminal with same designation as the connecting wire.

.4 Group terminal blocks according to voltage or signal level and function. Provide 150 mm space between rows of terminals blocks. Install no more than two conductors per block.

2.13 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 16010.

.2 Provide nameplates for all face-mounted components.

.3 Identify all interior sub-assemblies compartments with adhesive backed labels.

.4 Provide lamacoid warning nameplates, 5 mm white lettering on red background, indicating presence of live circuit when VFD is in normal mode. Mount on all access doors and internal compartment doors or barriers.

2.14 HEAVY DUTY

.1 VFDs to be heavy duty.

2.15 ACCEPTABLE PRODUCTS

.1 Acceptable Products:

.1 Eaton (Same as MCC manufacturer)

PART 3 - EXECUTION

3.1 CABINET ASSEMBLY

.1 In addition to shop drawings, provide hard and electronic assembly drawings, AutoCAD compatible.

.2 Provide test reports to the Consultant prior to shipping the cabinet to the site.

3.2 START-UP

.1 Refer to General Conditions.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Electric heaters to CSA 22.2 No. 46.

.2 Controls to CSA C22.2 No. 24.

1.2 RELATED WORK

.1 Electrical General Provisions: Section 16010.

.2 Electrical System Support Anchorage and Seismic Restraint: Section 16010.

.3 Vibration Isolation: Division 15.

.4 Inspection and Testing: Section 16031.

1.3 SUBMITTALS

.1 Submit following shop drawings:
- .1 Heaters, identify voltage, phase and power requirements.
- .2 Capacities.
- .3 Controls and accessories.
- .4 Mounting methods.
- .5 Cabinet material thickness.
- .6 Limitations.
- .7 Colour and finish.
- .8 Refer to Division 1.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATER

.1 Provide unit heaters of horizontal or vertical projection with controls and accessories as indicated.

.2 Finish:
- .1 Epoxy/polyester powder paint.

.3 Voltage:
- .1 Voltage and phase as indicated.

.4 Construction:
- .1 18-gauge steel.
- .2 Adjustable louvres to direct air flow.
- .3 High limit temperature control with automatic reset.

.5 Fan:
  .1 Motor mounted in cold compartment.
  .2 Thermally protected motor.
  .3 Totally enclosed and factory lubricated ball bearing motor.
  .4 58 dBA fan.
  .5 Fan delay purges heater of residual heat.

.6 Heating Element:
  .1 Durable tubular heating elements; stainless steel.
  .2 Concentric disposition of heating elements.

.7 Control:
  .1 Factory installed 120VAC control circuit. Unit heater to be controlled by a wall mount line voltage (120V) thermostat as indicated.
  .2 Provide the option to interlock each unit heater with an A/C unit.

.8 Wattage:
  .1 As indicated.

.9 Acceptable Product(s):
  .1 Ouellet OAS Series or approved equivalent.

.10 For each Electric Unit Heater, as indicated, provide a thermostat per the following:
  .1 Line voltage (120VAC)
  .2 Minimum range of 5°C to 25°C.
  .3 Number of contacts and contact rating to suit application. Minimum of two (2) poles.
  .4 Acceptable product(s):
    .1 Ouellet OTL222 Series or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation as per manufacturer’s recommendations.

.2 Coordinate location of heaters with other divisions.

.3 Wire heaters and controls as indicated and as per manufacturer’s instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

.1 Electrical contractor to provide CSA Certified electric heat trace cable with temperature control for freeze protection on Sampling Lines and Chemical Injection Lines noted on design drawings.

.2 Mechanical contractor is responsible for providing and installing all piping and insulation.

.3 Power and electrical details as per electrical design drawings.

.4 Insulation details as per mechanical design drawings.

1.2 SUBMITTALS

.1 Provide shop drawings per Division 1. Include heat trace calculations.

PART 2 - PRODUCT

2.1 HEATING CABLES

.1 Heating cable to be a self-regulation type cable to be used for freeze protection on process piping (insulated) above ground.

.2 Cable to have power output to suit and operate on 120 V or 208 V, as required by the application. Other series per the manufacturer’s recommendation.

.3 Standard type jacket (polyolefin).

.4 Specified Manufacturer: Raychem BTV Series.

.5 Provide Pentair Mineral Insulated Heating cables in hazardous locations.

2.2 ACCESSORIES

.1 High temperature glass filament tape attaching cable to pipe at 300 mm intervals. Metal or plastic cable ties are not permitted.

.2 Power connection, splice/tee and end seal kits to be compatible with selected heating cable.

.3 “Electric Traced” label. One installed every ten feet of pipe.

.4 Installation shall not require installing contractor to cut into the heating cable core to expose the bus wires.

.5 Connection kits shall be NEMA 4X rated to prevent water ingress and corrosion. All connection kits to be UV resistant.

.6 Connections kits shall be CSA Certified.

2.3 CONTROL

.1 Provide Pentair JBS-100-ECP-A and Pentair JBS-100-ECW-A electronic temperature controllers in non-hazardous areas. Select wall mount/pipe mount to suit application. Use Pentair Raystat-EX-03-A electronic thermostat in hazardous locations. Each controller to be equipped with at least one Form C contact for alarm monitoring by the plant control system.

PART 3 - EXECUTION

3.1 DESIGN

.1 Heat trace manufacturer to provide final heat trace design complete with component selections, including heating cable, controllers and all required appurtenances. Refer to drawings for specific heat trace requirements.

3.2 INSTALLATION

.1 Install heat trace cables according to design details and manufacturer’s instructions.

.2 Secure cable to piping at 300 mm intervals with recommended tape.

.3 Allow cable for valves, flanges, etc.

.4 Do not bunch or cross cable.

.5 Provide ground fault breakers, sized to suit.

.6 Provide contactors as required.

.7 Install labels on insulation.

.8 Follow manufacturer’s recommendations.

3.3 TESTING

.1 Test heating cable after installation on pipe and prior to insulation being installed.

.2 Test cables as per the manufacturers testing requirements:
- .1 Test A: Inner Dielectric jacket integrity test.
- .2 Test B: Outer jacket integrity test.

.3 Follow all required safety precautions, including locking out power.

.4 Megohmmeter to readings should be done at 500Vdc for 1 minute. Record the insulation resistance in the inspection report. Repeat above using 1000 and then 2400 Vdc.

.5 Refer to manufacturer’s insulation resistance criteria for acceptable testing results.

.6 Submit all test reports.

3.4 EQUIPMENT SELECTION

.1 Heat trace supplier shall provide written confirmation in the shop drawing that the selected cables, controllers and accessories will meet the requirements for the various applications as outlined in the drawings and per site conditions. Supplier to visit site as required.

3.5 CERTIFICATION

.1 Provide written documentation from the heat trace supplier confirming that the heat trace system is installed and commissioned and meets the manufacturer's requirements. The heat trace installation shall be inspected prior to installation to any pipe insulation or other materials that may obstruct visual inspection. The written documentation shall include annotated high quality colour photographs of the installations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE SECTIONS

.1 Reference Sections:
- .1 Section 17210 - PLC Specification, Basic Programming Requirements
- .2 Section 17500 - Control Narrative, General Overview
- .3 Section 17003 - Control Systems Specialist
- .4 Section 01021 - Equipment Testing, Commissioning and Operator Training
- .5 Systems Integration Proposal

1.2 SCOPE OF SUPPLY

.1 The scope of supply will generally be as listed in Part 2 of this specification section.

1.3 REFERENCE STANDARDS

.1 Electrical: CSA and local Electrical Inspection Authority Approval for complete installation.

.2 Electrical: any requirements of local Electrical Authority.

.3 Designed to be in compliance with all applicable municipal, provincial and national codes and standards.

.4 Industry standard for water/wastewater plant control systems.

1.4 TESTING AND COMMISSIONING

.1 Main SPS And WWTS controls to be thoroughly tested and verified in accordance with the specifications provided herein.

PART 2 - PRODUCTS

2.1 SCOPE OF SUPPLY

.1 The following is a summary of major services to be supplied. The list is not necessarily all inclusive and the proponents should include for all necessary options and accessories to meet the intent of the specifications.

.1 Provision of custom Control Panels (CP) as outlined.

.2 Provision of control systems instrumentation. In some cases, the supply and installation of some third party and HVAC instrumentation may be provided separately by other disciplines; however, the SI shall still provide systems coordination, start-up and commissioning assistance as well as control system documentation of such instruments as it integrates with custom control panels.

.3 Coordinate with other divisions and manufacturers' representatives to provide optimal installation drawings on how the various instruments will be installed on this project. These drawings shall be submitted with the individual instrument shop drawings for review.

.4 Provide all programming required for the new PLC(s) and existing PLCs. This may include temporary programming of new and/or existing PLCs and/or HMIs as required by the commissioning process.

.5 Provide all programming required for the Main SPS PLC and HMI, including modifications to the existing PLC and HMI system at the WWTS (Lagoon).

.6 Provide Operations and Maintenance Manuals as per Division 1.

.7 Provide Operator training as per Sections 17210 as well as per Division 1.

.8 Allow for an increase of up to 15% in the number of hardwired and networked I/O points.

.9 Configure all Ethernet switches and routers. This will include setting up VLANs, VPNs and other traffic management measures.

.10 Commission all Ethernet communications.

.11 Re-commission the alarm system including alarm dialing of new and modified alarms.

.12 Re-commission PLC communications with remote sites as required. Update the existing PLC logic for each remote site as required for full integration into the new Automation system; this includes alarming, trending, event logs, process screens, process reports, etc.

.10 PLC I/O verification of all hardwired and network I/O points.

.11 Coordination with the others discipline for the commissioning of the Main SPS And WWTS automation system. This may include access to the new PLCs for program setup and testing prior to site deployment. SI to also coordinate with the other discipline for up-to-date I/O lists and panel drawings. Refer to Section 17003.

.12 SI to coordinate with the Electrical Contractor for up-to-date equipment shop drawings, including shop drawings for pre-packaged equipment.

.13 Provide a detailed automation checkout report. The report to document normal and abnormal scenarios. Such scenarios shall test the system response to the failure of certain equipment and instruments as well system response to abnormal process conditions.

.14 Provide a detailed alarm verification report. All alarms to be set up with the assistance of the Operator, verified in the presence of the Operator and signed off by the Operator.

.15 Re-commission any I/O point and associated PLC and HMI if any of the following occurs:

.1 Associated wiring has been disconnected for any reason.

.2 Associated device/equipment installation has been altered since last commissioned.

.16 Allow for a minimum of fifteen (15) days on site for system verification with the Consultant. System verification may require more time onsite, depending on the issues that may be identified. System verification to occur over a minimum of a three-week period. Provide at least three (3) weeks notice to the Consultant for the system verification.

.17 Provide PLC logic to automatically log certain key process parameters in the PLC. The

parameter list to be coordinated with the Municipality and includes only data that is pertinent for MECP compliance and to be displayed on HMI screen.

.18 Develop Process Control Narratives (PCNs) based on the Process Narratives (PNs) provided in the contract documents. Programming can commence only once the PCNs have been approved.

.19 Meet with and coordinate with the Municipality's Operations personnel to obtain their input on the development of the PLC and HMI programs. This is to be done via a workshop to be organized and chaired by the SI. A minimum of one (1) workshop is required. Initial investigation and data gathering phase, concepts, HMI Style Guide, including HMI look and feel, tagging and colour standard, screen navigation, annotation and documentation standard, graphics, alarms, proposed network configuration and details. The workshop to be held at the Casselman Main SPS. It is expected that the contents of the PNs as well as pertinent shop drawings and I/O lists will also be discussed in the workshop. The SI to provide a plan for the workshop at the onset of the project, for review by the Municipality and the Consultant. SI to submit a detailed Automation system shop drawing. This shop drawing to detail the Automation system at that stage, including screenshots, HMI Style Guide, graphics, tags, alarms, operational settings, PLC annotation and documentation standard, HMI historical trends, proposed network configuration, HMI event logs, HMI process reports, draft PCNs, etc. The Automation shop drawings to also provide a summary of where and how the various physical and networked PLC I/O points are utilized in the Automation system.

.20 Provide comprehensive HMI/PLC SAT and associated commissioning of the entire Main SPS and WWTS automation system including the integration with the pre-packaged equipment.

.21 Commission the new alarm Autodialer.

.22 In addition to process HMI screens, the SI to also develop ancillary HMI screens for miscellaneous systems in the plant. These include but are not limited to: Hydro service and power distribution, HVAC (including room temperatures) and Main SPS and WWTS networks. This is to be discussed and coordinated with the Municipality's Operations staff.

.23 The SI to make use of the various data available over the Main SPS and WWTS networks to provide information to the plant personnel that may be beneficial in the efficient maintenance of the facility, while not overloading the HMI system with data that may not be beneficial to the Operators. Such details to be discussed in the workshops.

.24 The existing legacy Allen-Bradley PLC5 system inside ACP-100 at the Main SPS will be upgraded to CompactLogix. The SI to facilitate all programming required for this migration and a new PLC control panel as outlined.

.25 The existing legacy Allen-Bradley PLC5 system inside CP-2 at the WWTS (Lagoon) will be upgraded to CompactLogix. The SI to facilitate all programming required for this migration and provide to modification to the panel on site as well as providing all hardware accordingly.

.26 The existing OIM inside CP-2 at the WWTS will remain. The SI to facilitate all programming required to implement the existing system modification and upgrades.

.27 The SI to host meeting(s) with the SI team for each of the pre-packaged PLC-controlled equipment suppliers. The meetings to include all pertinent stakeholders. The meetings shall be scheduled to facilitate the contractor's overall schedule but also to ensure that the pre-packaged suppliers are briefed on the overall plant HMI standard once Owner buy-in has been achieved. As such, these meetings would be coordinated with the HMI workshops with the Municipality's Operations staff. An overall schedule of all meetings (HMI workshops plus meetings with pre-packaged suppliers) shall be presented early in the project via a shop drawing. The contractor shall make every effort for its pre-packaged suppliers to conform to the plant's HMI and PLC standard.

.28 SI to coordinate all PLC firmware for the site, including PLC firmware for pre-packaged PLC-controlled equipment suppliers. SI to ensure that such firmware is not outdated at the end of the project.

.29 The SI is to work around the operation of the existing Main SPS and WWTS. The continuous operation of this facility takes priority over their work.

.30 Refer to Section 01021 for further commissioning requirements, including system and facility testing as well as sequencing and scheduling. The SI shall adhere to and supplement the requirements outlined in Section 01021.

.31 SI to integrate and full commissioning of the existing Chart recorder as well as alarms testing and commissioning back to the Main SPS and WTP.

.32 Provide complete, fully commissioned turn-key communication installation between the Main SPS, Lagoon and WTP as required.

2.2 SCOPE OF SUPPLY BY OTHERS

.1 The following services will be provided by the Contractor:

.1 The Electrical Contractor to terminate and label all field wiring, including field wiring to the Control Cabinets.

.2 The Electrical Contractor to retain the services of an Ethernet network specialist to terminate and test all Ethernet cabling.

.3 An Electrician shall be available for system verification. System verification will involve disconnecting and reconnecting control wiring to simulate various conditions.

.4 Electrical Contractor to coordinate with the SI.

.5 The contractor to coordinate with its pre-packaged suppliers to follow the plant HMI and PLC standard.

.6 The Electrical Contractor shall ensure that all information that is required for the SI to complete its work is provided in a timely fashion. This includes but is not limited to: up-to-date I/O lists; latest equipment shop drawings, including pre-packaged equipment; latest construction schedule; sufficient notice on dates and times when pertinent commissioning personnel will be onsite to facilitate coordination with the SI; and coordination with commissioning personnel for the various equipment and systems. Extras associated with any additional costs associated with the failure of the Contractor to coordinate with its subs will not be entertained.

.7 The Contractor to facilitate coordination amongst its various suppliers and sub-contractors for the efficient execution of the project requirements. This includes coordination between the SI and the MCC supplier as well as other pertinent suppliers and sub-contractors.

2.3 QUALITY CONTROL

.1 The scope of work and responsibilities of the Control Systems Specialist must be performed by a single firm meeting the following minimum requirements:

.1 A Professional Engineer licensed to practice in the Province of Ontario.

.2 CSA certified electrical control panel manufacturing facility, per CSA 22.2 Standard for Industrial Control Equipment.

.3 Minimum five (5) years corporate and staff experience designing, providing, integrating, installing, and starting up similar systems as required for this Project.

.4 The site representative of the SI must have a minimum five (5) years experience installing similar systems as required for this Project.

2.4 PLC I/O COMMISSIONING

.1 The I/O commissioning report to include but not limited to the following:

.1 I/O tags.

.2 Tag description.

.3 I/O address (rack, slot and point) or network address, equipment tag and parameter.

.4 Pass/fail for each discrete I/O point. Provide separate pass/fail results for the I/O card LED status check, the PLC software check.

.5 Date and time each discrete I/O point was witnessed as well as initials of the witness.

.6 Measured (Engineering) value (plus units) calculated by the PLC at 4, 8, 12, 16 and 20 mA for each analog I/O point. Provide actual mA measurements using a NIST traceable digital multimeter. mA to be to two (2) decimal places. Measured values to be to one (1) decimal place for flows, levels, pressures, temperatures, currents and voltages. Measured values to be to two (2) decimal places for all analytical values, frequencies, power factor, valve position and valve feedback. Detail the upper and lower range limit for each measured value, for each analog I/O point.

.7 Provide separate measurements for all new and modified analog I/Os as indicated by the multimeter, the PLC and the HMI verification.

.8 Date and time each new or modified analog I/O point was witnessed as well as initials of the witness.

.9 Completed functional testing and system check sheets for all IO and equipment. Refer also to Section 01021.

.2 Submit the template I/O commissioning report for review by the Consultant prior to commissioning.

2.5 AUTOMATION VERIFICATION

.1 Provide a detailed automation verification report for each system/process including, but not limited to the following:

.1 Normal operating sequence.

.2 System reaction to various equipment/device failures as well as abnormal process conditions. List all such scenarios and detail system reaction to these scenarios. It is understood that such a list may not capture all possible conditions; however, a "reasonable" attempt shall be made to identify the more likely and important failure scenarios. Provide the Consultant with a proposed automation checkout report template for review. The template to list the scenarios proposed for testing. The template should be forwarded before commissioning commences.

.3 Once automation verification has been completed submit the reports to the Consultant for review. After which system verification can be scheduled.

2.6 ALARM COMMISSIONING

.1 Provide a detailed alarm verification report. The report to include, but not limited to the following fields:

.1 Tag

.2 Description

.3 I/O point/Ethernet node

.4 Alarm registered on HMI process screen (Yes/No)

.5 Alarm registered on HMI alarm banner (Yes/No)

.6 Alarm listed in HMI alarm history (Yes/No)

.7 Alarm dialed to the Operator (Yes/No)

.8 Alarm received by the Operator (Yes/No)

.9 Assigned autodialer channel

.10 Comments

.11 Name and signature of the person performing the test as well as that of the person accepting the test results (typically the Operator), plus the date the test was performed.

.12 The verification report to cover alarm dialing on the Main SPS Autodialer.

.2 Submit the template alarm commissioning report for review by the Consultant prior to commissioning.

2.7 HMI REPORTS PAGE

.1 Program the PLC and HMI system to display report information and to meet (or exceed) the following minimum requirements:

.1 The following reports shall be provided:

.1 Daily process
.2 Daily equipment
.3 Weekly process
.4 Weekly equipment
.5 Monthly process
.6 Monthly equipment
.7 Yearly process
.8 Yearly equipment

.2 Process reports shall contain the following:

.1 Minimum, average, maximum and total (flows) for key parameters in the Main SPS and WWTP. These parameters may include turbidity, flows, chlorine levels, etc. The exact listing of parameters will be determined during construction.

.3 Equipment reports shall contain the following:

.1 Runtimes (hours) and number starts for key equipment in the Main SPS and WWTS. Such equipment may include High lift pumps. The exact listing of equipment will be determined during construction.

2.8 PLC LOGGING

.1 Automatically log key process parameters in the PLC. The logged data will automatically be overwritten once the allotted PLC memory is full.

.2 Automatically log key process events in the PLC. The logged data will automatically be overwritten once the allotted PLC memory is full.

.3 Program the PLC to carefully manage memory for the efficient operation of the Main SPS and WWTS as well as future modifications to the system.

.4 The list of parameters to be logged as well as sample times is to be determined during construction.

.5 Each PLC shall be programmed to log the data associated with that PLC. Such data will include the process parameter values being monitored by that PLC over hardwired and device level network connections.

2.9 INSTRUMENTATION AND CONTROL PANEL COMMISSIONING

.1 Commissioning documents to include:

.1 Upper and lower range settings of all instrumentation provided.
.2 All settings of all devices commissioned by SI.
.3 Serial number for each device supplied.
.4 Make and model for each device supplied.

.5 Date (month and year) of manufacture of each device supplied.
.6 Calibration certificate for each instrument.

PART 3 - EXECUTION

3.1 START UP, TRAINING AND PERFORMANCE TESTING

.1 Allow for as many site visits as required for the thorough and complete testing and commissioning of the Main SPS and WWTS control system.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Refer to Section 16010.

1.2 PRODUCT DATA

.1 Provide shop drawings for cabinets and components as per Division 1. Indicate any conflicts with design drawings.

1.3 OPERATION AND MAINTENANCE DATA

.1 Operation and Maintenance Data:
  .1 As per Division 1.

1.4 SCOPE

.1 This section pertains to control panels, field control panels, local control panels, motor control panels, controls junction boxes and controls pull boxes.

PART 2 - PRODUCTS

2.1 ENCLOSURE

.1 Acceptable enclosure manufacturers:
  .1 Hammond
  .2 Hoffman
  .3 Cooper Industries (for NEMA 7/8 enclosures)

.2 Size enclosures to suit. Provide a minimum of 25% spare DIN rail and panel space.

.3 Enclosure to be ANSI 61 grey, except for stainless steel enclosures, which shall be unpainted.

.4 Enclosure to be rated for the intended environment and be a minimum of NEMA 12. Outdoor panels to be NEMA 4X, stainless steel. Provide NEMA 7 rated panels in hazardous indoor locations and NEMA 8 panels for hazardous outdoor locations.

.5 For each enclosure provide the following accessories at a minimum:
  .1 18” x 18” folding shelf. Folding shelf to be mounted at 1000 mm above finished grade and on the exterior of the cabinet door. Folding shelf is to be made of steel and be the same colour as the enclosure. Folding shelf make and model to be Ralston Z-5020 (or approved equivalent). Folding shelf only required for PLC panels.
  .2 Thermoplastic data pocket sized to hold 11” x 17” data sheets.
  .3 All panels (back and side) to be painted white and to be “full” panels. Panels to be from same manufacturer as enclosure. Provide full side (depth) panels, as required for

additional panel space.

.4 Provide enclosure climate control as required. If climate control is provided then provide temperature monitoring by the PLC and HMI. At a minimum provide temperature monitoring via thermostats. Climate control details:
  .1 Heaters: Hoffman DAH series electric heater with built-in fan and thermostat; or Hammond equivalent. Brushed aluminum finish.
  .2 Thermostats: Hoffman ADLTEMP dual thermostat; or Hammond equivalent. Temperature units to be Celsius.
  .3 Provide passive cooling, as required. If passive cooling is not sufficient, then provide active cooling. Cooling products shall be from Hoffman or Hammond. If fans are employed, provide dampers. Dampers from Belimo.
  .4 Include climate control design calculations and design in the shop drawings.

.5 For each outdoor panel, provide vent drain(s). Number to suit. Vent drains to be Hoffman H2OMIT series, or Hammond equivalent.

.6 For each PLC panel, provide LED lighting, sized to suit. Lighting to be activated when the enclosure door is open. Manufacturer to be same as for the enclosure.

.7 Copper ground bars, sized to suit plus 25% spare.

.8 Ground lugs capable of accepting 2/0 ground wire.

.9 Each PLC control panel to be free standing, single or double door as indicated and will be located indoors.

2.2 PROGRAMMABLE LOGIC CONTROLLER (PLC)

.1 Hardware:
  .1 As indicated.

.2 Analog signal multiplexing:
  .1 Phoenix Contact MCR-SL-UI-2UI analog isolator/duplicator where analog signal duplication is required.
  .2 As indicated.

.3 Acceptable PLC isolation, where required:
  .1 Phoenix Contact PLC-RSC Series 24VDC and 120VAC terminal style relays, screw connection.
  .2 Phoenix Contact MINI MCR-SL-UI-UI-NC configurable analog signal 3-way isolating amplifier, screw connection.
  .3 As indicated.

.4 PLC I/O Termination:
  .1 For each discrete input PLC I/O point, provide a Phoenix Contact UKK-5-MTK-P/P 2-tier knife disconnect terminal block.
  .2 Provide ground bars for drain/shield I/O wires, as required. Provide one (1) ground bar for each analog I/O card.
  .3 Group PLC I/O terminals according to the PLC slot # using Phoenix Contact Clipfix 35 end anchors complete with matching labels.
  .4 As indicated.

2.3 BONDING

.1 Each DIN Rail in each control cabinet is to be bonded using Phoenix Contact USLKG5 ground terminal. Analog I/O drain wires to be connected to ground bars, not ground terminals.

.2 Each panel and cabinet door is to be bonded as per manufacturer's recommendations.

.3 Each component is to be bonded as per manufacturer's recommendations.

.4 Bonding is to be in accordance with the latest revision of the Ontario Electrical Safety Code.

2.4 LABELLING

.1 All components and wires to be labeled.

.2 Each wire to be labelled individually. The use of one label for two or more wires is unacceptable. Similarly, where two wires are connected to the same connection point – each wire to be labelled.

.3 Labels to be printed by machine and should be done in a neat, organized manner, identifying each wire at its point of termination.

2.5 LOOSE COMPONENTS

.1 Provide the following loose components:
- .1 Five (5) of each type of terminal block.
- .2 Four (4) of each type of isolation (Analog and Discrete) device used.
- .3 Four (4) end brackets.
- .4 Four (4) spare 4A supplementary protectors.
- .5 Four (4) spare 2A supplementary protectors.

2.6 SHOP DRAWINGS

.1 Shop Drawings to include but not be limited to the following:
- .1 I/O diagrams.
- .2 Detailed enclosure/panel layout drawings and dimensions.
- .3 Detailed wiring diagrams, including wire labels and wire specifications.
- .4 Detailed loop diagrams, including junction boxes and associated terminals. Loop drawings to follow the ISA-S5.4 standard.
- .5 Symbols on controls drawings to follow the NEMA ICS standards.
- .6 Detailed network diagrams, including port and I/P address assignments.
- .7 Complete Bill of Materials.
- .8 Detailed shop drawing/data sheet for each device to be used in the enclosures.
- .9 Shop drawings to be on 8.5" x 11" and/or 11" x 17" sheets.

2.7 CONTROL CIRCUIT OVERCURRENT PROTECTION (120VAC/24VDC)

.1 Control Power Circuit Breakers/Supplementary Protectors:
- .1 Use only one manufacturer for all control circuit breakers and supplementary protectors.
- .2 Size circuit breakers/supplementary protectors to suit as per equipment manufacturer's recommendations.
- .3 Circuit breaker/supplementary protector installation according to the latest version of the Ontario Electrical Safety Code.
- .4 For each I/O card wiring provide a supplementary protector, sized to suit. Monitor the status of each I/O card supplementary protector on the PLC via a Phoenix Contact PLC-RSC series relay.
- .5 Each PLC control panel will be fed by non-UPS and UPS 120VAC power. Provide a circuit breaker for each power source. Also provide a circuit breaker on the output of each 24VDC power supply as well as each 24VAC power source.
- .6 Each circuit breaker is to be CSA C22.2 No. 5 compliant.
- .7 Each supplementary protector is to be CSA C22.2 No.235 compliant.
- .8 Acceptable products (Circuit Breaker):
  - .1 Allen-Bradley 1489-M series
  - .2 Schneider equivalent
- .9 Acceptable products (Supplementary Protectors):
  - .1 Allen-Bradley 1492-SP series
  - .2 Schneider equivalent

.2 Fuses are not acceptable unless used on the primary of a control transformer.

.3 Acceptable fuse holders (600V/120V/24V):
- .1 Ferraz Shawmut UltraSafe™ series complete with matching Bussmann fuses.

2.8 DC POWER SUPPLY

.1 Single-Phase Primary-Switched mode.

.2 120VAC input; 24VDC output.

.3 Mountable on 35 mm DIN rail without the need for additional accessories.

.4 IP20 Degree of protection.

.5 Mean Time Between Failures (MTBF) > 500,000 hours.

.6 cUL listed.

.7 Power supply to be a minimum of 10 A @ 24 VDC.

.8 Acceptable product:
- .1 As indicated, or Allen-Bradley 1606-XLS Series approved equivalent.

.9 Monitor the status of the 24VDC power supply on the PLC via the relay contact on the power supply as indicated.

.10 Same manufacturer for the DC power supply and the redundancy module.

2.9 ETHERNET SWITCH

.1 Provide Ethernet switch(es) in the PLC panel, as indicated.

.2 Ethernet switch(es) to be fully managed and rated for industrial applications.

.3 Acceptable product:
.1 As indicated.

2.10 ETHERNET PATCH CABLES (INSIDE CONTROL PANEL)

.1 Provide all patch cords required for Ethernet connections internal to each control cabinet.

.2 Select cord lengths to suit. Cords to be as short as possible.

.3 Provide three (3) spare 2 m long Cat. 6 patch cords.

.4 Category 6 patch cords to be Belden 7940 A series Category 6 patch cables.

.5 Each end of each patch cord is to be labelled with the matching manufacturer's label. All labels to be printed by machine. Handwritten labels are not acceptable.

2.11 MANUAL OPERATOR INTERFACE (PUSHBUTTONS, PILOT LIGHTS, ETC.)

.1 Each pilot light to meet the following:
.1 Factory assembled
.2 Push-to-test
.3 120VAC LED
.4 NEMA 4/13 watertight rated. NEMA 7&9, as required to suit area classification.
.5 Colour as indicated
.6 30 mm diameter
.7 Heavy industrial rated
.8 Finger-safe guards
.9 CSA certified
.10 Acceptable product:
.1 Allen-Bradley 800TC/800H series
.11 Pilot light colours:
.1 Amber: Fault
.2 Red: Stopped
.3 Green: Running
.4 Colours not final until shop drawings have been reviewed.

.2 Each 3-position selector switch to meet the following:

.1 Factory assembled
.2 Finger-safe guards
.3 Non-illuminated
.4 Standard knob with white insert
.5 Maintained Operator function
.6 Contact rating of 600VAC and 600VDC
.7 30 mm diameter
.8 NEMA 4/13 watertight rated. NEMA 7&9, as required to suit area classification.
.9 Number of contacts as required for the control circuit. Capable of accepting additional contact blocks.
.10 Heavy industrial rated
.11 CSA certified
.12 Acceptable product:
.1 Allen-Bradley 800TC/800H series

.3 Each 2-position selector switch to meet the following:
.1 Factory assembled
.2 Finger-safe guards
.3 Non-illuminated
.4 Standard knob with white insert
.5 Maintained Operator function
.6 Contact rating of 600VAC and 600VDC
.7 30 mm diameter
.8 NEMA 4/13 watertight rated. NEMA 7&9, as required to suit area classification.
.9 Number of contacts as required for the control circuit. Capable of accepting additional contact blocks.
.10 Heavy industrial rated
.11 CSA certified
.12 Acceptable product:
.1 Allen-Bradley 800TC/800H series

.4 Each potentiometer to meet the following:
.1 Factory assembled
.2 Finger-safe guards
.3 Non-illuminated
.4 Standard knob with white insert
.5 30 mm diameter
.6 NEMA 4/13 watertight rated. NEMA 7&9, as required to suit area classification.
.7 Resistance rating to suit.
.8 Heavy industrial rated
.9 CSA certified
.10 Acceptable product:
.1 Allen-Bradley 800TC/800H series

.5 Each pushbutton to meet the following:
.1 Factory assembled
.2 Finger-safe guards
.3 Non-illuminated

.4 Colour as indicated
.5 Contact rating of 600VAC and 600VDC
.6 30 mm diameter
.7 NEMA 4/13 watertight rated. NEMA 7&9, as required to suit area classification.
.8 Number of contacts as required for the control circuit. Capable of accepting additional contact blocks.
.9 Heavy industrial rated
.10 Extended head for stop operations, flush head otherwise
.11 CSA certified
.12 Acceptable product:
.1 Allen-Bradley 800TC/800H series

.6 Each emergency stop to meet the following:
.1 Factory assembled
.2 Finger-safe guards
.3 Non-illuminated
.4 Red cap
.5 Contact rating of 600VAC and 600VDC
.6 30 mm diameter
.7 NEMA 4/13 watertight rated. NEMA 7&9, as required to suit area classification.
.8 Number of contacts as required for the control circuit. Capable of accepting additional contact blocks.
.9 Heavy industrial rated
.10 Mushroom head, 2-position push-pull
.11 CSA certified
.12 Acceptable product:
.1 Allen-Bradley 800TC/800H series

.7 Each legend plate shall meet the following:
.1 Provide a legend plate for each of the following:
.1 Pilot light
.2 Selector switch
.3 Potentiometer
.4 Pushbutton
.5 Emergency stop
.2 Aluminum
.3 NEMA 4/13 watertight rated
.4 Engraved by the manufacturer
.5 Gray in colour
.6 Acceptable product:
.1 Allen-Bradley 800T standard or jumbo legend plate

.8 Provide a machine engraved lamacoid for equipment identification for each set of Operator Interface devices on each control panel. Each lamacoid to be 20 mm x 100 mm with white background and black 5 mm characters.

.9 Each AC Hour meter to meet the following:
.1 Records up to 99,999 hours; automatically resets to zero
.2 120VAC, 60Hz

.3 Accuracy of at least ± 0.02%
.4 Screw termination
.5 Glass lens
.6 CSA certified
.7 Acceptable product:
.1 Hobbs 20000 series Round 3 Screw AC Hour Meter, or approved equivalent.

.10 For each VFD provide the following local Operator interface at the motor:
.1 Fault pilot light
.2 Stopped pilot light
.3 Running pilot light
.4 3-position Hand-Off-Auto selector switch
.5 0-to-100% potentiometer

2.12 GRAPHICAL OPERATOR INTERFACE (HMI)

.1 As indicated.

2.13 SURGE SUPPRESSION AND EMI

.1 Provide all accessories required to mitigate surges for all components, such as relays, that cause surges in power distribution.

.2 For each of the 120VAC power sources into the PLC panel provide a Total Protection Solutions TK-LTE120/TK-120LT series surge protective device. Size SPD to suit. Provide a surge suppression device with form C contact for monitoring by the PLC.

.3 Ensure proper voltage separation is observed as per manufacturer’s recommendations.

.4 Route wires and cables to minimize EMI effects on Class 2 wiring.

.5 Provide ferrite collars and other accessories as required to minimize EMI.

.6 Follow manufacturer’s recommendations with respect to EMI mitigation.

2.14 FINGER-SAFE WIRING

.1 All wiring to be IP-2X (Finger-safe) rated. Provide all accessories as required for finger-safe ratings.

2.15 FAIL-SAFE WIRING

.1 All alarms to be wired fail-safe. Provide all accessories as required.

2.16 CABINET LABELLING

.1 Cabinet labeling to be finalized upon shop drawing review.

2.17 PROGRAMMING/ACCESS OUTLETS

.1 For the PLC control panel, provide a programming outlet on the door of the panel. Outlet to be mounted at a height of approximately 150 mm above the shelf. Programming outlet to meet the following:
- .1 CAT 6, RJ45 (female)
- .2 Duplex GFCI receptacle with test/reset pushbuttons on the outside
- .3 NEMA 4/12 housing, clear cover
- .4 Non-GFCI inside/outside version
- .5 Acceptable product:
  - .1 Grace Engineered Products Inc. Model number as indicated.

2.18 UTILITY RECEPTACLE

.1 Provide a Hubbell DRUB15 series 5-15R duplex utility receptacle inside the PLC control panel, as indicated.

.2 Utility receptacle to be fed from UPS power.

.3 Provide appropriate marking.

.4 Receptacle to be orange in colour.

2.19 WIRING DUCT

.1 Control cabinet wiring ducts to be Panduit F series narrow slot. Provide Panduit corner ducts where side (depth) panels are used. Duct colour to be light grey. Use blue duct for intrinsically safe circuits.

2.20 DATA DISPLAYS

.1 Provide a data display to display each critical process parameter, as indicated.

.2 Acceptable products:
- .1 Precision Digital PD765 Series

2.21 INSPECTION

.1 All cabinets to pass CSA inspection. Provide labels in conspicuous locations.

2.22 CONTROL POWER

.1 Control power shall be 120VAC. 24VDC power to be used for the analog instrumentation and other components, as required.

.2 Where required, 24VAC is acceptable for certain equipment.

.3 Control transformers to be Allen-Bradley 1497 series or approved equivalent, complete with IP2X appurtenances, as required for IP2X wiring rating.

2.23 DIN RAIL

.1 DIN rails to be Allen-Bradley 199-DR1 35 mm x 15 mm symmetrical zinc plated or approved equivalent.

2.24 MISCELLANEOUS TERMINAL BLOCKS

.1 Miscellaneous terminals blocks in the control cabinets to be Phoenix Contact UK 5N or approved equivalent.

.2 Phoenix Contact UK 6N (or Weidmuller equivalent) shall be employed if any of the following applies:
- .1 Wiring is #12 AWG or larger
- .2 Current exceeds 20A
- .3 600VAC applications.

2.25 GENERAL PURPOSE RELAYS

.1 General purpose control relays shall meet the following:
- .1 Minimum of 2-poles.
- .2 Minimum pilot duty rating: NEMA C300 (AC) and R300 (DC)
- .3 Rated thermal current: 7A (4-pole); 10A (2-pole)
- .4 Dielectric withstand voltage: 2000V (pole-to-pole) and 4000V (contact to coil)
- .5 IP20 (guarded terminal sockets)
- .6 Mechanical life cycles: 20 x 106 (AC) and 50 x 106 (DC)
- .7 Switching frequency operations: 1800/hour
- .8 Minimum operating rate: 8 cycles/second
- .9 Operating time: max pickup: 10ms; max dropout: 3ms
- .10 Rated insulation voltage: 300V
- .11 Standards: CSA 22.2 No. 14
- .12 Contact material: AgNi
- .13 Specified Product:
  - .1 Allen-Bradley 700-HC Series complete with push-to-test and LED options. Provide matching surge suppressor.

2.26 600V POWER DISTRIBUTION BLOCKS

.1 Each power distribution block shall meet the following:

.2 Finger-safe (IP20) construction, per IEC 529, without the need for special covers such as plexiglass sheets.

.3 Mountable on 35 mm DIN rail without the need for additional accessories.

.4 600V rated.

.5 Captive termination screws.

.6 Multiple wire ratings.

.7 CSA certified.

.8 Specified Product:

.1 Ferraz Shawmut FSPDB series finger-safe power distribution blocks complete with the following matching accessories:

.1 Accessory pin to form multiple pole block

.2 Cap plugs for spare 2/0 and 350 MCM openings

.3 End anchors

2.27 FIELD WIRING CONNECTIONS

.1 Each panel shall be wired such that field wiring is connected to terminal blocks and not directly to a panel component. This includes motor and power field connections.

2.28 PANEL LAYOUT

.1 During shop drawing review, the Consultant reserves the right to request changes to the panel layout to suit site conditions, at no extra charge.

.2 The Control Systems Specialist is to review the contract drawings to determine how field wiring will enter the panel – the layout of the panel shall be designed accordingly, subject to the approval of the Consultant.

2.29 CONTROL CABINET (INTERNAL) WIRING

.1 Refer to drawings for wiring requirements.

PART 3 - INSTALLATION

3.1 TERMINAL BLOCKS

.1 Follow manufacturers recommendation.

.2 Fasten railings to back planes, on panel doors using S.S. button head type bolts. Bolt size and length to suit. Provide nuts and washers as required.

.3 Label terminals clearly with scratch resistant machine produced plastic inserts.

.4 Label strips as per the drawings. For strips greater than 20 blocks, label at each end and for strips greater than 40 blocks label intermittently to suit.

.5 Provide terminal blocks in all control panels, motor control panels, field control panels, local control panels and junction boxes for wire management.

3.2 WIRE DUCTS

.1 Follow manufactures recommendations.

.2 Fasten ducts to back planes, on panel doors using S.S. button head type bolts. Bolt size and length to suit. Provide nuts and washers as required.

.3 Provide wire ducts in all control panels, field control panels, motor control panels, local control panels and junction boxes for wire management.

3.3 WIRING

.1 Keep analog and digital wiring separate.

.2 Use ties and spiral wrap to maintain a neat appearance.

.3 Ensure adequate cable lengths for minor adjustments in the terminal blocks.

.4 All alarm and warning signals to be wired fail-safe unless otherwise indicated. Provide all appurtenances required to facilitate such wiring, including but not limited relays, terminal blocks, etc.

.5 All wiring to be terminated on terminal blocks. The use of marrettes (or equivalent) is not acceptable.

.6 All internal wiring for all control panels and motor control panels shall be terminated using crimp-on ferrules. Only one wire per ferrule. Ensure all strands of the wire are crimped within the ferrule and that there are no stray strands of wire.

.7 No more than two (2) wires to be connected to the same side of a terminal. Provide additional terminals as required.

.8 Wiring in accordance with the latest revision of the Ontario Electrical Safety Code as well as applicable CSA Standards.

.9 Follow manufacturer’s recommendations for installation and wiring of components.

.10 Secure wires in wire duct using cable ties. Leave enough slack on the cable ties for wire manipulation. Remove excess cable tie ends. Cable tie application to be done in a neat and organized manner.

.11 All PLC I/O points to be terminated, including spare I/O points.

.12 All alarms to be wired in a fail-safe manner, such that an input is always present on the PLC input card, unless there is an alarm.

.13 Provide a two-tier knife terminal block for each discrete.

.14 Provide a glass fused terminal block for each analog I/O point.

.15 Each DIN rail in each control panel shall be bonded. Provide ground terminals to suit.

.16 Refer to the contract drawings for additional details.

3.4 LOOP SHOP TEST

.1 Notify Consultant of date of testing. The Consultant will at his discretion attend the shop tests. Make available marked-up copies of the cabinet and loop drawings for the shop test.

.2 Test all wiring loops, display devices and hand switches in the shop and prepare report.

.3 Provide the Consultant with a copy of the results of the loop test for review prior to delivery of the cabinets to the site.

END OF SECTION

PART 1 – GENERAL

1.1 RELATED SECTIONS

.1 Section 16010 – Electrical General Provisions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
  .1 TIA/EIA-568-B.1-(2001), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
  .2 TIA/EIA-568-B.2-(2001), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
  .3 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.

1.3 DEFINITIONS

.1 Refer to TIA/EIA-598-C, Annex A for definitions of terms.

1.4 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consist of twisted-pair cables, terminations, connectors, cross-connection hardware, and related equipment installed inside building for control system communication.

.2 Installed in physical star configuration with separate horizontal and backbone sub-systems.
  .1 Horizontal cables link work areas (Ethernet ports) to control/IT cabinets located in the same area.
  .2 Backbone cables link control/IT cabinets to control/IT cabinets.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Division 1.

.2 As-Built Records and Drawings as per Division 1.

PART 2 - PRODUCTS

2.1 FOUR-PAIR BALANCED UNSHIELDED TWISTED PAIR (UTP) CATEGORY 6 CABLE

.1 Ethernet/IP compliant.

.2 UV sunlight resistant.

.3 Industrial grade jacket.

.4 Solid conductors.

.5 CEC CMR FT4 (riser).

.6 Operating temperature range: -40°C to 75°C.

.7 Third party verified to TIA/EIA-568-B.2, Category 6.

.8 Colours per drawings.

.9 Specified Product:
.1 Belden 7940 A. Provide armoured version, where indicated.

2.2 WORK AREA UTP 4-PAIR MODULAR OUTLET

.1 Eight-position modular jack ("RJ-45"), type T568A Category 6 to: TIA/EIA-568- B.2:
.1 In self-contained single-gang surface-mount box, 4 jacks per box.
.2 Mounted in compatible single gang faceplate, angle entry, 4 jack positions per faceplate.
.3 Faceplates to be white in colour in office areas. Provide stainless steel faceplates in process area.

.2 Multi-user telecommunications outlet assembly (MUTOA), 4 ports, each port equipped with factory installed "RJ-45" jacks, type T568A Category 6 to: TIA/EIA-568-B.2.

.3 All horizontal cabling to be terminated at work area on 8 pin type modular connectors (RJ45) with insulation displacement-type connection.

.4 All Category 6 modular jacks to be terminated in accordance with TIA/EIA-568.

.5 Modular RJ45 connectors to be compliant with Keystone mechanical mounting configuration.

.6 Eight-position modular telecommunications outlet/connectors to accept four- or six-position modular plugs while providing proper electrical connection and not damaging telecommunications outlet/connector (jack) or modular cord. Manufacturer to warrant all eight-position modular outlets used in such a manner to be usable for eight-position modular plugs in the future.

.7 The durability of the jack module to be 1000 mating cycles minimum.

.8 The IDC termination on the modular jack to make a reliable contact without cutting the wire. The change in IDC contact resistance not to exceed 1 mΩ over the life of the modular plug.

.9 Performance of Category 6 modular jacks to be equal to or better than, the TIA/EIA-568-B.2 Category 6 pair to pair NEXT performance specifications.

.10 The UTP connector module to be FCC Part 68, Subpart F compliant.

.11 Terminate all ports on each outlet.

.12 Provide faceplate and all appurtenances required for a complete installation.

.13 Colours per drawings.

.14 Specified Product:
.1 Belden EZ-MDVO modules complete with matching faceplates.

2.3 UTP PATCH CORDS

.1 2 metres long, with factory-installed male plug at one end to mate with "RJ-45" jack and with factory-installed male plug at other end to mate with "RJ-45" jack Category 6, 4 pairs to: TIA/EIA-568-B.2.

.2 Provide one patch cord for each terminated port plus twelve (12). This does not include patch cords internal to the control panels which shall be provided by the Panel Builder. Turnover spare patch cords to the Owner in original unopened packaging.

.3 Patch cord colours per drawings.

.4 Specified Product:
.1 Belden 7940A series.

2.4 LABELS

.1 To meet the legibility, defacement, exposure and adhesion requirements of UL 969.

.2 To be preprinted or laser printed type.

.3 Where used for cable marking, provide Vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. If the cable jacket is white, provide a cable label with printing area that is any other colour than white, preferable orange or yellow so that the labels are easily distinguishable.

.4 Where insert type labels are used provide clear plastic cover over label.

.5 Labeling to meet the requirements of TIA/EIA-606-A.

2.5 SYSTEM CERTIFICATION AND WARRANTY

.1 A certification program provided by the manufacturer of the cabling infrastructure to cover the installed cabling system.

.2 The cabling system certification to provide the assurance that all present and future applications engineered for the performance level of the cabling system used will function over the cabling system.

.3 Prompt corrective action to be taken should the cabling system fail to support the application(s) designed to operate over it – whether at the time of cut over to the new cabling system, during subsequent use, or after upgrading to a new supported application during the construction and warranty periods.

.4 Certify that the installed cabling system conforms to all applicable local building and electrical codes.

PART 3 - EXECUTION

3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE

.1 Install termination and cross-connect hardware indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-A.

3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install horizontal cables as indicated in conduits from control panels to individual work-area jacks. Identify and label as indicated to: TIA/EIA-606-A.

.2 Terminate horizontal cables in control panels and at individual work-area jacks.
  .1 Identify and label as indicated to: TIA/EIA-606-A.

3.3 INSTALLATION OF BACKBONE CABLES

.1 Terminate backbone cables in control panels as indicated and according to manufacturers' instructions.
  .1 Identify and label as indicated to: TIA/EIA-606-A.

3.4 IMPLEMENT CROSS-CONNECTIONS

.1 Implement cross-connections using patch cords as specified.

3.5 FIELD QUALITY CONTROL

.1 Test horizontal UTP cables as specified below and correct deficiencies, provide record of results as electronic copy.
  .1 Perform tests for Permanent Link on installed cables, including spares:
  .2 Category 6 using certified level III tester to: TIA/EIA-568-B.2.
    .1 Perform tests for Channel on 100% of cross-connected data horizontal cabling installed from each control panel, including shortest and longest drops from each control panel.

.2 Test backbone UTP cables as specified below and correct deficiencies: provide record of results as electronic copy.
  .1 Perform tests for Permanent Link on 4-pair cables:
    .1 Category 6 using certified level III tester to: TIA/EIA-568-B.2.
    .2 Perform Wire Map tests on multi-pair UTP cables to: TIA/EIA-568-B.1.

.3 Provide record of the results as electronic copy to: TIA/TSB-140.

3.6 DISTRIBUTION CABLING

.1 Install distribution outlet drops in locations and with configurations as detailed in the drawings.

.2 Mount two-port faceplate using single gang adapter ring on double gang box by Division 16 at each point

of service.

.3 Terminate each Category 6 permanent link on a RJ45 jack on one port of the common horizontal drop faceplate, and on a CAT 6 patch panel in control panel, or on male connection in control panel.

.4 All Category 6 modular jacks to be terminated in accordance with ANSI/TIA/EIA-568-B.1 Figure 6-1 (T568A configuration).

.5 Test each distribution drop. All cabling and terminations comprising each horizontal port link shall conform to the performance as detailed in paragraph 3.5.

3.7 IDENTIFICATION .1 AND LABELING

.1 Cable and termination identification requirements:

.1 The faceplate of each point of service to be labeled with the designation of the supporting control panel, e.g. CP-100', 'CP-400'.

.2 Individual Ports at each point of service: Are labeled using the format:

<Panel> <Port#>
where:
Panel corresponds to PLC panels or IT racks.

Port # is a two-digit number of the jack on the terminating jack panel. For panels terminating horizontal distribution, values range from '01 onwards'.

.3 Backbone Cables: each backbone cable shall be identified and labeled using the following format:
<Panel 1> <Panel 2>
where:
Panel 1/Panel 2 corresponds to PLC panel or IT rack.

.2 Labelling Application:

.1 Identification labels to be affixed to backbone cables with 15 cm of the following: each end of the cable, each side of a sleeve through floor slab; wall or other obstacle; entry and exit into a conduit; entry and exit points from a cable tray; and, any other location as needed to visually establish the identity of the cable.

.2 Horizontal distribution cables to be labeled on the termination faceplate at the point of service, the termination panel in the control panel and 5 cm from each end of the cable.

.3 Identification labels also to be affixed to distribution cables within 300 mm of the following: each end or termination, each side of a sleeve through floor slab; wall or other obstacle; entry and exit into a conduit; entry and exit points from a cable tray; and, other locations as needed to visually establish the identity of the cable.

3.8 GROUNDING AND BONDING

.1 As per ANSI J-STD-607-A, Section 16045 and the equipment manufacturers' recommendations.

3.9 CLEANING

.1 Upon completion of system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt and construction debris and repair damaged finish, including chips, scratches and abrasions.

3.10 DEMONSTRATION

.1 Operate control/signal systems to demonstrate proper functioning over the telecommunications infrastructure.

.2 Replace malfunctioning cable with new materials, and then retest and re-commission until satisfactory performance is achieved.

3.11 ACCEPTANCE

.1 Acceptance with be withheld until the following have been completed successfully:
- .1 Acceptance of all submittals.
- .2 Delivery of final documentation.
- .3 Successful testing.
- .4 Successful demonstration, including operation of systems using the cable, training and manual review.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Submissions: Section 16010 and Division 1.

.2 Shop Drawings: Provide a copy of the Table of Programmable Parameters for each applicable Component.

.3 Maintenance Manuals: Provide a copy of the Table of Programmable Parameters for each applicable Device. Reference Sections:

1.2 DEFINITIONS

.1 Commissioning: Verification of installation (mechanical, power and control wiring), energizing and calibrating of equipment.

.2 On drawings in Table of Devices, each device is defined by a component code. Component Codes are comprised of two parts a single digit Alpha Descriptor and two digit Numeric Qualifier.

.3 Alpha Descriptor are as follows:
- .1 A – Analysis.
- .2 H – Hand.
- .3 J – Power.
- .4 L – Level.
- .5 M – Motion.
- .6 N – Miscellaneous.
- .7 O – Output.
- .8 P – Pressure.
- .9 R – Relays.
- .10 T – Temperature.
- .11 U - Process Control.
- .12 Z – Position.

.4 Table of Programmable Parameters: Manufacturer or Contractor created table listing all of the programmable parameters of a Device. Table is to contain separate columns for parameter codes, description, factory default values, commissioning, substantial performance review, and final inspection. Table is to be in electronic format for standard commercially available software or manufacturer’s propriety software only if it is supplied as part of the contract. Programmable parameters include jumpers and dip switches as well as software selectable options. Table headers are to contain the JLR#, project name, Device Tag, Component Code, date, and column titles.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS

.1 Shop Drawings to outline options for each component. Include all components for a complete installation.

.2 Shop Drawings to include installation details including specific piping, valving and mounting for all installation sensitive instruments. This will require co-ordination from the General, Mechanical, Electrical, and Control Systems Specialist.

.3 Provide a Table of Programmable parameters for each device.

2.2 CALIBRATION AND CERTIFICATION EQUIPMENT

.1 The MECP requires annual certification of certain process equipment.

.2 Include the supply of all cables, transmitters, software and any other device or testing equipment to meet the MECP requirements. One set per project for each type of device is required. Allow for eight (8) hours of operator training over two sessions one (1) month apart.

2.3 EQUIPMENT TAGGING

.1 Each instrument is to be provided with a stainless steel tag with the equipment tag imprinted on the tag. Connection to the instrument is via stainless steel chain or other approved method. Where the transmitter is remote to the sensor, provide a separate tag for each. Provide shop drawing of each tag for approval.

2.4 F01

.1 Electromagnetic Flowmeter (Remote Sensor):
- .1 Sensor:
  - .1 Liner material: hard rubber or polyurethane, suitable for wastewater applications.
  - .2 Process connection: ASME B 16.5 CLASS 150 carbon steel flanges.
  - .3 Electrodes: 316L stainless steel.
  - .4 Cable length: specified by Contractor.
  - .5 Accuracy: +/- 0.5%; submit flow calculations for review.
  - .6 NEMA 4X.
- .2 Transmitter:
  - .1 Cable entries: ½" NPT.
  - .2 Programmable via keypad.
  - .3 Illuminated LCD display.
  - .4 Non-volatile memory.
  - .5 User selectable units of measure.
  - .6 CSA general purpose.
  - .7 NEMA 4X.
  - .8 4-20mA output.
  - .9 4-wire.
  - .10 24VDC power.
  - .11 HART protocol.
  - .12 Wall mount.
- .3 3-point calibration.

.4 Size as indicated.
.5 Accuracy: +/- 0.5%.
.6 Acceptable Products:
  .1 Endress and Hauser.
  .2 Siemens MAG 5100W c/w MAG 5000/6000 equivalent

2.5 N01

.1 True On-Line, Double Conversion, Power Line Isolated UPS:
  .1 Input/Output voltages: 208VAC-120VAC/208VAC-120VAC, single phase (L-L, N).
  .2 VA Rating: 3,000 VA/2700 W.
  .3 0.95 pF at full load.
  .4 Minimum of two (2) L5-30R outlets at 120/208 VAC.
  .5 Power input and output via hardwiring.
  .6 Surge suppression.
  .7 Tower configuration.
  .8 Battery:
    .1 Sealed lead-acid/maintenance free.
    .2 8 minutes of protection at 80% of full load.
    .3 4-hour charge time at 80% of full load.
    .4 On-line automatic test without exposing load.
  .9 Acceptable product(s):
    .1 PowerWare 9SX series, complete with relay interface card.

2.6 O01

.1 Stacklight:
  .1 LED rotating, stackable indictor.
  .2 70mm Stacklight
  .3 Flashing light
  .4 120 VAC.
  .5 Mounting as indicated.
  .6 NEMA 4X rated. Suitable for outdoor installation.
  .7 cUL/CSA approved.
  .8 Minimum temperature range of -30°C to +55°C.
  .9 PLC compatible.
  .10 Provide colours as indicated.
  .11 Configurable.
  .12 Acceptable product(s):
    .1 Edwards Signaling 200 Class 70 mm Stacklight Series.

2.7 P01

.1 Pressure Transmitter:
  .1 Linear deviation less than 0.2% of span with long-term stability better than 0.1%.
  .2 Dry capacitive ceramic sensor-resistant to overload and water hammer; vacuum-tight.
  .3 316 stainless steel, NEMA 4X. Suitable for outdoor installation. Temperature rating of -40 deg. Celsius to +40 deg. Celsius.
  .4 Units in kPa.

.5 ½" NPT, IP66 cable entry.
.6 ½" NPT process connection.
.7 Seal material: EPDM.
.8 Zone 1 as required for process.
.9 LCD display.
.10 24 VDC power supply, two wire (loop powered).
.11 4 – 20 mA with HART.
.12 Manufacturer's bracket for pipe and wall mounting.
.13 Provide manifold (block and bleed valve).
.14 Acceptable products:
    .1 Endress + Hauser Cerabar S Series.
    .2 Siemens DSIII Series equivalent.

2.8 T01

.1 Plant Indoor Ambient Temperature (Electrical room):
.1 4-20 mA output, 2-wire operation.
.2 HART protocol.
.3 Configurable input and output.
.4 CSA or equivalent approval.
.5 Illuminated, rotatable display.
.6 NEMA 4X, IP67 Die cast aluminum housing.
.7 100 ohm platinum RTD element.
.8 Zone 1 to suit environment.
.9 Acceptable product(s):
    .1 Endress & Hauser TMT142 Series.

2.9 T50

.1 Smoke Detector:
.1 Photoelectric with integrated 135 degree fixed temperature/ rate of rise heat sensors.
.2 85 dBA sounder (temporal 3 pattern).
.3 Auxiliary dry contact rated for 24 VDC at 1.0A.
.4 Dust compensation.
.5 Field replaceable optical chambers.
.6 Self-diagnostics.
.7 LED light for status identification.
.8 Integral reed switch for diagnostics; can be activated by magnet. Meets NFPA 72 sensitivity testing requirements.
.9 cUL approval.
.10 Acceptable product:
    .1 Edwards Signaling 521N Series. Provide a total of ten (1) replacement chambers for the site. Use canned smoke for functional testing.

2.10 T90

.1 Thermostat:
.1 Line voltage (120 VAC).
.2 Minimum range of 5°C to 25°C.
.3 Number of contacts and contact rating to suit application. Minimum of two (2) poles.

.4 Acceptable product(s):
.1 Ouellet OTL222 Series or approved equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Each device is to be installed in accordance with the manufacturer's recommendations.

3.2 ON-SITE START-UP AND COMMISSIONING

.1 Include as many visits as are necessary to start up and ensure trouble free and specified operation of the system. Be aware that various devices may be commissioned over a several week period.

.2 Provide Tables of Programmable Parameters for devices indicated. Have a copy of the tables available for the substantial performance review and final inspection. Update tables and distribute electronic (in format acceptable to the Consultant and Owner) or hard copies upon request. Provide updated copies of the tables in electronic format and hard copy for the maintenance manuals.

.3 Manufacturers representatives are to be on site with the Consultant for the substantial performance review and as required by the Contractor for commissioning. Consultant may request the presence of the manufacturer's representatives for final inspection based upon the performance of the system during the substantial performance review.

3.3 START-UP

.1 Start-up of the following equipment must be made by a manufacturer's representative. Include as many visits as are necessary by the manufacturer's representative to start up and ensure trouble free and specified operation of the system.
.1 All devices supplied.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 As per Section 17500.

.2 Refer to Sections 17002 and 17003.

1.2 PRODUCT DATA

.1 As per Instructions to Proponents.

1.3 OPERATION AND MAINTENANCE DATA

.1 As per Instructions to Proponents.

PART 2 - PRODUCTS

2.1 INTENT

.1 PLC programming is to be written in a clear organized fashion.

.2 Provide comments and descriptions as required to ensure that the program can be understood by a programmer not involved in the project.

.3 Logic should follow process.

.4 Group logic for each process loop in blocks.

.5 PLC programs must follow the existing PLC programming philosophy.

.6 PLC program must follow existing SLC program logic.

2.2 MEMORY BLOCK ASSIGNMENT

.1 Group like components (field devices, counters, timers) together.

.2 Allow space for future additions to components in each group.

.3 Provide a map or description of the memory assignments.

2.3 VARIABLE ASSIGNMENT

.1 Use descriptive names (tags) mapped to I/O addresses. Used existing program naming conventions and standard.

.2 Provide a description of each tag, including I/O address and field tag or operational description for internal variables.

.3 Provide variables that are mapped to an address for exchange with the HMI for:
- .1 "Run-Time Metering" hours of operation for all specified equipment.
- .2 "Idle-Time Metering" hours of operation for all specified equipment.

2.4 DATA TRANSFER

.1 Preselected Equipment PLCs will require control of intelligent devices connected to Main SPS and WWTS PLC via fieldbus. Treatment Process Equipment Supplier to ensure that control and status is available to preselected equipment PLCs.

.2 Preselected Equipment PLCs will collect analog values, generate alarm and status bits. Treatment Equipment Supplier to ensure that this information is available at the Main SPS and WWTS PLCs and HMI.

.3 The operators will control the preselected equipment via HMI. SI to ensure that control data is available to Preselected Equipment PLCs.

2.5 OPERATOR SET POINTS

.1 Set point and ranges are to be mapped to an address for exchange with the HMI or a field device.

.2 Use descriptive tags.

2.6 COMMON SOFTWARE FUNCTIONS

.1 Where practical, call functions and pass variables to reduce the length of program.

.2 List and describe functions in detail so that the function may be used by future programmers if additions or updates are required.

.3 Test functions thoroughly.

.4 Lead - Lag Duty:
- .1 Equipment will operate the Lead device until a specified condition or Operator Adjustable set point is reached, in which the Lag device will engage as well.
- .2 Timed Lead - Lag Duty:
  - .1 The operator will have the capability of adjusting a Lead operational time limit through HMI.
  - .2 Once the Lead device has expired its operational time limit, it will become the Lag device on the next start up, and the Lag device will become Lead.
- .3 Operational Lead - Lag Duty:
  - .1 After every device operation, the duty is toggled between equipment. The Lag device becomes Lead, and the Lead device becomes Lag.

.5 Device Auto-Duty Rotation:
- .1 Three (3) Device:

.1 The operator will have the capability of adjusting an operational time limit through SCADA before device duty rotation. Once the limit has expired, the roll of each device will rotate as follows:
.1 The Lag device will become the Lead device.
.2 The Lead device will become the Standby device.
.3 The Standby device will become the Lag device.
.2 If one piece of equipment is taken out of rotation, the others are to continue to rotate.

.6 Tank Level Operation:
.1 Tank level Operation logic to be re-used and converted from SLC program.

2.7 FIELDBUS DEVICES

.1 When mapping to memory allow for addition of future points without the requirement to adjust the memory mapping for other devices.

.2 VFDs:
.1 Map the following points to memory and provide at HMI:

.1	Fault	(Descriptive word)
.2	Run status	(Bit)
.3	Auto mode	(Bit)
.4	Phase loss	(Bit)
.5	Phase imbalance	(Bit)
.6	Average current	(Floating Point)
.7	Run control	(Bit)
.8	Fault reset	(Bit)
.9	Speed control	(Floating Point)
.10	Speed feedback	(Floating Point)
.11	Minimum speed	(Floating Point)
.12	Maximum speed	(Floating Point).

2.8 PID LOOPS

.1 List and describe PID loops.

.2 List and describe variables; provide functional ranges for each.

.3 Provide the Consultant the PID formulas used from the PLC manufacturer.

.4 Tune PID loops with the appropriate control method as specified below and turn over all field notes to the Consultant:
.1 Flow control:
.1 PI Control (proportional - integral).
.2 Liquid Pressure control:
.1 PI Control (proportional - integral).
.3 Temperature control:
.1 PID Control (proportional - integral - derivative).
.4 Level control:
.1 PID Control (proportional - integral - derivative). Use very little integral gain.

.5 Gas pressure:
.1 PID Control (proportional - integral - derivative). Use very little integral gain.
.6 Gains and other parameters are to be mapped with an address for exchange with the SCADA or a field device.

2.9 COMMUNICATIONS

.1 Set up program to reduce communication traffic.

.2 Arrange data transfer in words.

.3 List and describe transferable words.

2.10 TIME DELAYS

.1 Incorporate time delays where required to prevent nuisance alarms.

.2 Incorporate time delays for motor running alarms.

.3 Incorporate time delays for valve open/close confirmation.

PART 3 - INSTALLATION

3.1 FUNCTION DIAGRAMS

.1 Prior to starting programming, review drawings and specifications to establish function diagrams. Contact Consultant to clarify any concerns, omissions, or ambiguities.

.2 Submit function diagrams to Consultant for review prior to starting programming.

.3 Clearly indicate data transfers between the system and preselected equipment controllers.

.4 Update list as project progresses.

3.2 VARIABLE ASSIGNMENTS

.1 Provide a list of variables (tags) complete with descriptions. SI will be responsible for master list, including tags from preselected equipment PLCs.

.2 Submit list of variables to Consultant for review and written approval prior to starting programming.

.3 Update list as project progresses.

3.3 IMPLEMENTATION MEETING

.1 Once the function diagrams and list of variables have been reviewed by the Consultant, a meeting will be held:

.1 The meeting will cover:
  .1 Function diagrams for major loops.
  .2 Alarms.
  .3 Operator interfaces.
  .4 Changes to the proposed function diagrams for major loops
.2 The meeting will be held at the Main SPS.
.3 Attending the meeting will be:
  .1 System Integrator
  .2 General Contractor
  .3 Consultant
  .4 Owner
  .5 Operator

3.4 TESTING / SIMULATIONS

.1 Once field-wiring tests have been completed and accepted, simulations can begin.

.2 Once the System Integrator has completed his preliminary testing and submitted a report to the Consultant, the Consultant will witness a complete simulation of the system operation.

.3 System Integrator is to provide all required testing equipment and simulate devices with switches and lights. Simulate analog signals with acceptable test equipment.

3.5 COMMISSIONING

.1 Once field-wiring tests have been completed and accepted, simulations can begin.

.2 Following successful equipment startup, in conjunction with the Operator manipulate the process to simulate variations including probable failures.

.3 Consultant and Owner to be present for final acceptance tests.

.4 For final acceptance prove:
  .1 Proper operation of control loops.
  .2 PID functions.
  .3 Alarm points.
  .4 Emergency shutdown.
  .5 Watch dog timers.

3.6 TRAINING

.1 Prepare instruction manual and train the Owners personnel to:
  .1 Resetting the PLC(s).
  .2 Interpreting indicators on the PLC modules.
  .3 Replacing a failed I/O card in the PLC.
  .4 Accessing and monitoring the program.
  .5 Restarting Operator Interface Terminal

.2 Training session is required. Allow session to be a minimum of three (3) hours.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Provide test procedures for each device and for control strategies prior to commissioning.

.2 Process Control Narratives to be developed per the Municipality's standards.

.3 Process Control Narratives to be reviewed prior to software FAT.

1.2 OPERATION AND MAINTENANCE DATA

.1 As per Instructions to Proponents.

PART 2 - PRODUCTS

2.1 INTENT

.1 To provide a seamless PLC based automation and control system that allows operators to monitor the process and related alarms.

2.2 PLC OPERATION

.1 Prepare system configuration for use by the PLC manufacturer at factory acceptance test.

.2 Automated controls must be operational for the 14-day equipment acceptance tests.

PART 3 - PRODUCTS

3.1 PROGRAMMING

.1 Program the PLC to perform the functions described in Part 2.

.2 Provide appropriate documentation for the thorough understanding of the programming. Provide Table of Variables for the PLC(s) and HMI and other plants.

.3 Provide table of VFD default parameters table and parameters being modified.

.4 Program PLC to monitoring key parameters of the VFD such as load voltage, load amperage, speed, etc. Provide trend on local HMI as required.

.5 Allow for alterations of scales and colours by the Owner during the Final Design Meeting.

3.2 COMMISSIONING

.1 Test each function individually. Provide the Engineer with a report prior to commissioning the system.

.2 Once loops have been tested and accepted, start up system. Engineer and Owner to be present for final acceptance tests.

.3 For final acceptance prove the general proper operation of:

.1 Data exchange over Ethernet network.

.2 Data exchange with PLC control panel and "fail safe" operation.

.3 Proper operation of instruments.

.4 Proper manual control of devices (motors, valves, etc.).

.5 Monitoring of instruments and devices.

.6 Final acceptance of specific reviews will be listed in Control Narratives for the General Contract for each specific process area.

3.3 TRAINING

.1 In the specified training period, provide the operators with a general understanding of:

.1 Tag structures.

.2 System architecture.

.3 Ethernet data exchange.

.2 In the specific sections of the Control Narrative, requirements for instructions are outlined.

END OF SECTION

General control requirements

.1 All equipment failures are to alarm.
.2 Trend all analog signals, and log when each discrete signal changes state.
.3 Trend pump speeds when they are equipped with a VFD.
.4 Trend pump run times.
.5 Trend discharge pressure.
.6 Trend wet well level.
.7 Trend daily volumes for each flow meter.
.8 Duty/Standby and lead/lag systems are to alternate their associated duty/standby or Lead/Lag equipment on either an operator adjustable time basis or based on number of starts. Operators to be able to switch between the two options.
.9 All equipment to have a remote manual control option such that the equipment can be put into manual mode from station HMI, and have all parameters operated and adjusted by operators through station HMI.
.10 The following OEM provided control systems are to have their screens integrated into the station HMI system such that the operators are able to see the full function of the OEM system, and adjust all parameters remotely.
    .1 Screening and screenings conveyor System
.11 Failure Modes. Unless noted otherwise:
    .1 If a duty pump fails, then the standby pump is to become the duty pump.
    .2 No motorized equipment is on UPS, so upon loss of power, all motorized equipment will de-energize and will resume normal operation when power is restored.

Raw Sewage Pumping Station Sequence of Operation

.1 The raw sewage pumping station is used to pump raw sewage, collected from the gravity sewers and other pumping station throughout Casselman, to the lagoon distribution chamber.
.2 Three raw sewage pumps, P-10011, P-10021, and P-10031 will operate in a lead/lag/standby configuration and will operate to maintain a constant liquid level within the raw sewage wet wells of 55.636m.
.3 The pumps will modulate to maintain liquid level in the wet wells as determined by LE-10003.
.4 The lead pump will be capable of handling low flows. If the lead pump is at maximum speed, and the level continues to rise, then the duty pump is to be energized.
.5 If both the lead and lag pump are operating at low speed, and the level continues to drop, lag pump to de-energize.
.6 If at low flow, and the lead pump is at minimum speed set point, and liquid level in the tank drops below the low liquid level set point (54.236m), the lead pump will de-energize.
.7 When the liquid level in the tank increases to high liquid level set point, the lead pump will activate and modulate speed to maintain a consistent liquid level in the tank.
.8 Manual Mode:
    .1 Automatic: A local control panel will display “RUNNING”, “STOPPED”, and “FAULT”. and include a HOA selector switch.
    .2 Manual: When a pump is in Manual Mode, Automatic Mode for that pump will be stopped. Manual mode will consist of an HOA selector switch and a potentiometer for speed control.
.9 Failure Mode:
    .1 If the lead sensor fails, the system will operate as a fill draw cycle. The lead pump will start at elevation 55.636 at maximum speed. The lag pump will start if the elevation in the wet well reaches 56.236. All pumps to stop if the elevation drops to 54.236.
    .2 If the elevation in the wet well reaches 56.436m, then both the lead and lag pumps are to energize at maximum speed for a set duration to empty the wet well. Duration to be determined during commissioning. Duration to be set as not to ever have the pumps run dry.

Alum Sequence of Operation

.1 Alum is to be dosed into the raw sewage forcemains when the raw sewage pumps are discharging.
.2 The alum pumps will operate in a duty/duty/standby configuration.
.3 Alum Pump P-11101 to operate when flow is detected using FE-10001 through the existing raw sewage forcemain.
.4 Alum Pump P-11301 to operate when flow is detected using FE-11001 through the new forcemain.
.5 The alum pumps are to modulate their speed to maintain the operator set concentration in the forcemain. Pumps to modulate based on their respective flow meters.
.6 Existing alarms and operations of the Alum tank are not modified as part of this upgrade.
.7 If one of the pumps fails, it is to alarm, and operators are to operate the manual valves such that the backup pump can be put into service. Operators to bring that pump online for the proper flow meter.

END OF SECTION

PART C – APPENDICES

Appendix No. 1

Designated Substances Survey and Reports

Appendix No. 2

Geotechnical and Hydrogeological Reports

Casselman Main Sewage Pumping Station Upgrade

Corporation of the Village of Casselman

Attachment 1 – Geotechnical and Hydrogeological Investigation

GEMTEC
www.gemtec.ca

Geotechnical and Hydrogeological Investigation
Casselman Main Sewage Pumping Station Upgrades
Casselman, Ontario

GEMTEC
www.gemtec.ca

Submitted to:

J. L. Richards & Associates Limited
700-1565 Carling Avenue
Ottawa, Ontario
K1Z 8R1

Geotechnical and Hydrogeological Investigation
Casselman Main Sewage Pumping Station Upgrades
Casselman, Ontario

January 6, 2025
Project: 100117.051-Rev1

experience • knowledge • integrity

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Ottawa, ON, Canada
K2K 2A9

January 6, 2025 File: 100117.051-Rev1

J. L. Richards & Associates Limited
700-1565 Carling Avenue
Ottawa, Ontario
K1Z 8R1

Attention: Mr. Jordan Morrissette, P.Eng., M.Eng.

Re: Geotechnical and Hydrogeological Investigation
Casselman Main Sewage Pumping Station Upgrades
Casselman, Ontario

Please find enclosed our geotechnical and hydrogeological investigation report for the above noted project, in accordance with our proposal dated January 26, 2024, and revised July 17, 2024. This report was prepared by Mr. Luc Bouchard, P.Eng. ing.

Luc Bouchard, P.Eng. ing.

LB/AP/DC/AB

Enclosures
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1.0 INTRODUCTION

This report presents the results of a geotechnical and hydrogeological investigation carried out by GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) for the proposed Casselman Main Sewage Pumping Station Upgrades project in Casselman, Ontario (see Borehole Location Plan, Figure A1 to A3) in Appendix A.

The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of boreholes and probe holes and, based on the factual information obtained along with supplemental information from a previous geotechnical investigation undertaken at the site by Golder Associates, to provide engineering guidelines and recommendations on the geotechnical design aspects of the project, including construction considerations that could influence design decisions. In addition, hydraulic testing was carried out to assess the hydraulic conductivity of the soil at selected locations along the proposed alignment. The investigation was carried out in general accordance with our proposals dated January 26, 2024, and July 17, 2024.

The results of the Environmental Excess Soil Investigation and a Species at Risk assessment carried out by GEMTEC are provided in separate reports.

This report is subject to the Conditions and Limitations of This Report, which follows the text of the report, and which are considered an integral part of the report.

2.0 BACKGROUND

2.1 Project Description

Based on information provided to GEMTEC by JLR the project will consist of upgrading the existing Casselman Main Sewage Pumping Station (SPS). Details of the proposed works are shown on drawings C101 to C109 inclusive, titled “Forcemain Plan & Profile” dated September 2024 and prepared by J.L. Richards. The upgrading works include:

- Installation of a new 525 millimetre diameter concrete overflow pipe and flapper type gate value. The overflow pipe will be installed from an existing manhole on the north side of the SPS, with the flapper gate outletting into the South Nation River a relatively short distance to the north of the SPS. The details of this component of the works are to be confirmed., however shallow excavations within about 3 metres depth are anticipated.
- Installation of a new 400 millimetre diameter HDPE forcemain from the existing SPS at the intersection of Brisson Street and Principale Street to the location identified as Lagoon Cell 1 East Berm. The length of forcemain to be installed is about 2,000 metres. The alignment is expected to be along the same alignment as the existing forcemain (within road allowances and existing easements). The forcemain will be constructed within Laurier Street.

It is also understood full road width reconstruction is being considered along Brisson Street, and that trench reinstatement of the roadway is being considered along Laurier Street, the Sainte-Euphémie Catholic Elementary School, and the lagoon access road.

2.2 Summary of Existing Information

From a review of geological maps its noted that variable soil conditions are identified along the pipeline routes. These include the following:

- Fine-textured glaciomarine deposits of silt and clay with minor sand and gravel in the vicinity of the SPS and lagoons;
- Sandy silt to silty sand glacial till, which frequently contains cobbles and boulders east of the pump station;
- Coarse-textured glaciomarine deposits of sand and gravel with minor silt and clay in the vicinity of the lagoons.

The mapped bedrock types include limestone, dolostone, shale and sandstone of the Shallow Lake Formation.

Table 2.1 provides a summary of available information for the existing pipelines and anticipated conditions in the area of the sewers. In addition to the anticipated conditions identified in the table fill material associated with the existing roadway and buried services should also be expected – particularly where excavations are carried out next to or through existing utility / service trenches.

JLR has provided GEMTEC with the report "Application for a Permit to Take Water for Construction Excavation Dewatering, Sewage Pumping Station Expansion and Upgrade, Casselman, Ontario" by Golder Associates, dated March 2006. The report, which is referred to further as Golder (2006) includes borehole logs of the overburden material along the original alignment of the forcemain. Upon review of the logs, the overburden material is noted to be consistent with the anticipated overburden material provided in Table 2.1. It is understood that GEMTEC is permitted to use the information within the report for the purpose of this investigation.

Table 2.1: Summary of Available Information

Roadway Segment	Length (metres)	Approximate Invert Depth of Existing Sewer (metres)	Anticipated Overburden Material
New Influent Sewer at SPS (To Be Confirmed)	-	6 to 7	Fill Material, Silty clay, Shallow Bedrock
Brisson St (SPS (pump station) to easement)	285	2.6 to 3.2	Fill Material, Silty clay, Shallow Bedrock

Roadway Segment	Length (metres)	Approximate Invert Depth of Existing Sewer (metres)	Anticipated Overburden Material
Easement (from Brisson St. to Laurier St)	650	2.5 to 3.0	Silty clay, glacial till, Shallow Bedrock Along West Portion of the Easement
Laurier St (Easement to Lagoon Access Road)	225	3.0 to 3.5	Silty Clay, Glacial Till, Possible Bedrock Near Mid-Point
Lagoon Access Road (Laurier St. to Berm Between Lagoon Cells)	480	2.5 to 3.0	Sand, Silty Clay, Glacial Till
Berm Between Lagoon Cells (Lagoon Access Rd to project limit)	290	2.5	Fill material, Sand, Silty Clay, Glacial Till

3.0 SUBSURFACE INVESTIGATION

3.1 Geotechnical Investigation

The fieldwork for this investigation was carried out between July 18 and July 26, 2024. During that time, a total of 17 boreholes and probe holes were advanced within the project area. Details of the ground investigation points are provided in Table 3.1.

The boreholes were advanced using a truck and a track mounted drill rig supplied and operated by George Downing Estate Drilling Ltd. of Grenville-Sur-La-Rouge, Quebec.

The fieldwork was observed by members of our engineering staff who directed the drilling operations, observed the in-situ testing and logged the samples and boreholes. Standard penetration tests (SPT) were carried out where possible within the overburden deposits and samples of the soils encountered were recovered using drive open sampling equipment. The bedrock samples were collected using HQ size coring equipment.

Table 3.1: Ground Investigation Details

Borehole ID	Ground Surface Elevation (metres)	Borehole Depth (metres)	Cored Bedrock (Y/N)	Well Screen Installed (Y/N)
24-1	61.9	3.8 (Refusal)	N	N
MW24-1	62.0	4.0 (Refusal)	N	Y
24-2	59.2	4.4	Y	N
24-3	58.6	1.9 (Refusal)	N	N
24-4	58.3	4.9	Y	Y
24-5	Removed from work program due to unlocatable sanitary forcemain			
24-6	63.9	4.42	N	N
24-7 (probe)	64.4	4.6	N	N
24-8	65.8	4.4	N	N
24-9 (probe)	66.5	4.6	N	N
24-10	65.4	4.4	N	Y
24-11 (probe)	65.4	5.2	N	N
24-12	64.8	5.2	N	N
24-13	Removed from work program due to unlocatable sanitary forcemain			
24-14 (probe)	67.7	4.6	N	N
24-15	67.8	4.4	N	N
24-16	67.6	6.7	N	Y
24-17	67.7	4.4	N	N
24-18	61.5	8.8	Y	Y

Well screens were sealed in the overburden at boreholes MW24-1, 24-4, 24-10, 24-16, and 24-18 to measure the groundwater levels, carry out hydraulic testing, and to allow groundwater sampling. Well screens were surrounded by a sand filter pack, above which bentonite sealant, native materials, and/or sand were used to fill the annular space back to surface. Details of the well construction are presented on the Record of Borehole sheets in Appendix B. It should be noted that the monitoring well MW24-1 was constructed about 1.5 metres south of borehole 24-1.

Following the borehole drilling work, the soil and bedrock samples were returned to our laboratory for examination by a geotechnical engineer. Selected samples of the soil were tested for water content, grain size distribution, Atterberg limits testing, and unconfined compressive strength testing. Samples of the groundwater were recovered from selected boreholes and sent to Paracel Laboratories Ltd. for basic chemical testing relating to corrosion of buried concrete and steel.

The approximate locations of the boreholes are shown on the Borehole Location Plan, Figure A1 to A3 provided in Appendix A. Descriptions of the subsurface conditions logged in the boreholes are provided on the Record of Borehole Sheets in Appendix B. The results of the soil classification testing are provided in Appendix C.

The borehole locations were positioned at the site by GEMTEC personnel and placed relative to existing site features. The location and ground surface elevations at the boreholes were determined using a Trimble R10 GPS survey instrument. The elevations are referenced to datum CGVD28.

3.2 Hydrogeological Investigation

3.2.1 Hydraulic Testing

Hydraulic testing was carried out in the well screens to estimate the hydraulic conductivity of the overburden soils within the anticipated depth of possible excavations and, if possible, to provide an estimate of the potential quantity of water entering future excavations.

The hydraulic testing consisted of a series of bail down tests. Bail down testing involved introducing a rapid pressure decrease to the water column within the well screen by pumping the well rapidly and monitoring the recovery of the water level over time using a groundwater data logging pressure transducer together with an electric water level tape. A summary of the hydraulic testing carried out is provided in Table 3.2.

The water level recovery was analysed in Aqtesolv® Version 4.50 (HydroSOLVE Inc., 2007) to estimate the hydraulic conductivities of screened materials.

Table 3.2: Summary of Hydraulic Testing

Borehole / Well ID	Geological Material Screened
MW24-1	Silty Clay / Silty Sand (Glacial Till)
24-4	Bedrock
24-10	Silty Sand (Glacial Till)

Borehole / Well ID	Geological Material Screened
24-16	Silty Sand / Silty Clay
24-18	Bedrock

Notes: Soil layers from MW24-1 are assumed to be comparable to borehole 24-1

3.2.2 Groundwater Quality Sampling

Groundwater quality samples were collected from the monitoring wells at boreholes 24-10, 24-16, and 24-18 on August 8, 2024. Boreholes 24-10, 24-16, and 24-18 were resampled on September 10, 2024, due to high sediment loads in the original samples, following additional well development. All samples were collected in laboratory supplied bottles and submitted to a CALA-accredited laboratory. The first samples were submitted for the "Baseline Monitoring Report" parameters, as described in the "Request to Discharge Wastewater from Construction Remediation Projects" application form, distributed by the City of Ottawa, and filtered metals; these parameters include pH, electrical conductivity, total suspended solids, volatile suspended solids, total and dissolved phosphorous, Total Kjeldahl Nitrogen (TKN), total PHCs, volatile organic compounds, semi-volatile organic compounds, hexachlorobenzene (pesticide), dissolved and total metals, and polychlorinated biphenyls. The second round of samples included a subset of the same parameters that may have been impacted by excessive sediments in the first round and dissolved phosphorous.

4.0 SUBSURFACE CONDITIONS

A description of the subsurface conditions along portions of the project extent are provided in the subsections below. These are as follows:

- SPS and Brission Street
- Field and School Yard
- Laurier Street
- Lagoon area.

4.1 SPS and Brisson Street (Boreholes 24-1 to 24-4, and 24-18)

4.1.1 Existing Roadway Structure

Boreholes 24-1 to 24-4 inclusive were advanced through the roadway structure along Brisson Street. At borehole 24-1, the roadway consisted of about 30 millimetres of asphaltic concrete overlying about 0.4 metres of grey, crushed sand and gravel with trace silt (base/subbase material).

At boreholes 24-2 to 24-4, the gravel roadway structure consists of about 0.2 to 0.7 metres of grey crushed sand and gravel with trace silt (Roadway Material) from surface.

The water content of a sample of the base/subbase material from borehole 24-1 is about 3 percent.

4.1.2 Topsoil

At boreholes 24-18, an 80-millimetre-thick layer of topsoil was encountered at ground surface.

4.1.3 Fill Material

Fill material was encountered below the gravel roadway structure at boreholes 24-2 and 24-3, and below the topsoil at boreholes 24-18. The fill material generally consists brown silty sand with varying amounts of gravel, silt, and clay. Boulders were inferred in the fill material at borehole 24-18. The fill material at boreholes 24-3 consisted of grey gravel with some sand.

In the roadway, the fill material thickness is about 1 metre at the borehole locations. At the location of borehole 24-18, by the SPS, the fill material has a thickness of about 4.6 metres.

Standard penetration tests carried out in the fill material gave N values of 2 to greater than 50 blows per 0.3 metres of penetration, which reflect a very loose to very dense relative density. The higher N values may reflect the presence of cobbles and boulders or other hard material within the fill material.

A grain size distribution test was undertaken on a sample of the fill material from borehole 24-18. The results are provided in Appendix C and are summarized in the Table 4.1. The water content of samples of the fill material from borehole 24-18 range from about 15 to 23 percent.

Table 4.1: Summary of Grain Size Distribution Results – Fill Material

Borehole & Sample ID	Depth (metres)	Clay (<2 µm) (%)	Silt (2 - 75 µm) (%)	Sand (75 µm - 5 mm) (%)	Gravel (5 - 80 mm) (%)	Water Content (%)
24-18 (SA4)	2.3 – 2.9	31	42	22	5	19

4.1.4 Silty Clay

A native deposit of silty clay was encountered at boreholes 24-1 to 24-3 at depths ranging from about 0.4 to 1.2 metres below surface grade.

The silty clay encountered has been weathered to a grey brown and red brown crust. The silty clay has a thickness ranging from about 0.7 to 2.6 metres and extends to a depth of about 1.9 to

3.1 metres. Borehole 24-3 was terminated within the silty clay at a depth of 1.9 metres due to auger refusal on the inferred bedrock surface (at about elevation 56.8 metres).

Standard penetration tests carried out in the weathered silty clay gave N values of 7 to 14 blows per 0.3 metres of penetration, which reflect a stiff to very stiff consistency.

Grain size distribution tests and an Atterberg limits tests were undertaken on samples of the silty clay. The results are provided in Appendix C and are summarized in the Tables 4.2 and 4.3.

The moisture content of samples of the silty clay was found to range from about 20 to 41 percent. The moisture content of the samples tested are generally below the measured liquid limit value.

Table 4.2: Summary of Grain Size Distribution Results – Silty Clay Deposit

Borehole & Sample ID	Depth (metres)	Clay (<2 µm) (%)	Silt (2 - 75 µm) (%)	Sand (75 µm - 5 mm) (%)	Gravel (5 - 80 mm) (%)
24-1 (SA3)	1.5 – 2.1	68	31	1	0

Table 4.3: Summary of Atterberg Limits Test Results

Borehole & Sample ID	Depth (metres)	Liquid Limit (%)	Plastic Limit (%)	Water Content (%)
24-1 (SA3)	1.5 – 2.1	57	24	28

4.1.5 Glacial Till

Deposits of glacial till were encountered below the silty clay in boreholes 24-1 and 24-2 at depths of 3.1 and 2.3 metres below surface grade, respectively. Borehole 24-1 was terminated within the glacial till deposits at about 3.8 metres below ground surface at auger refusal.

The glacial till can be generally described as brown and grey silty sand with variable amounts of clay, silt and gravel. Cobbles and boulders should be expected within the glacial till.

Standard penetration tests carried out in the glacial till gave an N values of 34 to greater than 50 blows per 0.3 metres of penetration, which reflects dense to very dense relative density. However, the higher N values may also indicate the presence of cobbles or boulders within the glacial till.

The water content of a glacial till sample from borehole 24-1 was about 11 percent.

4.1.6 Auger Refusal / Bedrock

Auger refusal on the inferred bedrock surface was encountered at all of the borehole locations at depths of 0.7 to 4.6 metres below surface grade (elevations 56.7 to 58.1 metres).

Rotary coring was carried out at boreholes 24-2, 24-4, and 24-18 to confirm the presence of bedrock at these locations. The recovered bedrock core consists of slightly weathered to fresh limestone bedrock with shale beds which has close to moderately close discontinuity spacings. The solid core recovery (SCR) values range from about 77 to 99 percent, and the rock quality designation (RQD) values range from about 48 to 92 percent. Therefore, the bedrock quality according to the recovered core samples is poor to excellent. It should be noted that the quality of the bedrock is lower near the surface of the bedrock. Bedrock core photographs are provided in Appendix F.

Selected samples of bedrock core were tested for unconfined compressive strength and the results are summarized in Table 4.4 below. Based the results the strength of the recovered core samples may be classified as strong to very strong, according to the rock strength classification system provide in the Canadian Foundation Engineering Manual, 4th Edition.

Table 4.4: Unconfined Compressive Strength of Bedrock Cores

Borehole ID	Sample No.	Depth (metres)	Unconfined Compressive Strength (MPa)
24-2	RC5	2.54 – 2.76	85
24-4	RC4	2.94 – 3.14	65
24-18	RC12	6.66 – 6.71	97

4.1.7 Golder (2006) Borehole Logs, BH05-1 to BH05-7

Four boreholes identified as BH05-1 to BH05-4 from Golder (2006) were advanced around the pumps station, and three boreholes identified as BH05-5 to BH05-7 were advanced along Brisson Street.

The subsurface conditions described in Golder (2006) appear relatively consistent with those encountered by GEMTEC. Around the SPS in boreholes 05-1 to 05-4 bedrock was confirmed at 1 location at a depth of 3.7 metres (elevation 57.1 m), and auger refusal occurred at a depth of about 3.0 metres below surface grade (elevations 57.2 to 57.6 metres). Further north along Brison Street, in boreholes 05-05 to 05-07 auger refusal was encountered at depths of 1.3 to 2.0 metres below surface grade (elevations 56.5 to 57.8 metres).

4.2 Field / School Yard (Boreholes 24-6, 24-8 and 24-10, Probeholes 24-07 and 24-09)

4.2.1 Topsoil

The field boreholes 24-6 and 24-8 were advanced through a surficial layer of topsoil ranging in thickness from 30 millimetres to 50 millimetres.

4.2.2 Access Roadway Structure

Borehole 24-10 was advanced through the school yard access roadway structure near Laurier Street. The access roadway structure consisted of about 100 millimetres of asphaltic concrete overlying about 550 millimetres of grey, crushed sand and gravel with trace silt (base/subbase material).

The water content of a sample of the base/subbase material was about 4 percent.

4.2.3 Fill Material

Fill material was encountered below the topsoil at borehole 24-8. The fill material consists brown silty clay with trace sand and has a thickness of about 1.0 metres.

Standard penetration tests carried out in the fill material gave N values of 2 to 3 blows per 0.3 metres of penetration.

4.2.4 Former Topsoil

A former topsoil layer was encountered below the fill material in borehole 24-8 at a depth of about 1.1 metres.

4.2.5 Silty Clay

A native deposit of silty clay was encountered below the topsoil and former topsoil at boreholes 24-6 and 24-8 at depths ranging of about 0.0 and 1.1 metres, and below the pavement structure at borehole 24-10 at a depth of about 0.7 metres.

The silty clay has been weathered to a grey brown and red brown crust, has a thickness ranging from about 1.7 to 2.6 metres, and extends to a depth of about 2.4 to 2.8 metres.

Standard penetration tests carried out in the weathered silty clay gave N values of 3 to 12 blows per 0.3 metres of penetration, which reflect a stiff to very stiff consistency.

A grain size distribution and Atterberg limits test was undertaken on a sample of the weathered silty clay from boreholes 24-10. The results are provided on the Record of Borehole Sheets in Appendix B and are summarized in the Tables 4.5 and 4.6. The moisture content of samples of the weathered silty clay was found to range from about 25 to 51 percent. The moisture content of the samples tested are below the measured liquid limit value.

Table 4.5: Summary of Grain Size Distribution Results – Silty Clay

Borehole & Sample ID	Depth (metres)	Clay (<2 µm) (%)	Silt (2 - 75 µm) (%)	Sand (75 µm - 5 mm) (%)	Gravel (5 - 80 mm) (%)
24-10 (SA3)	1.5 – 2.1	73	26	1	0

Table 4.6: Summary of Atterberg Limits Test Results – Silty Clay

Borehole & Sample ID	Depth (metres)	Liquid Limit (%)	Plastic Limit (%)	Water Content (%)
24-10 (SA3)	1.5 – 2.1	59	26	51

4.2.6 Glacial Till

Deposits of glacial till were encountered below the silty clay in boreholes 24-6, 24-8, and 24-10 at depth of 2.4 to 2.8 metres. The boreholes were terminated within the glacial till deposit at a depth of about 4.4 metres below ground surface (elevation 59.5 to 61.3 metres).

The glacial till can be generally described as grey brown and grey silty sand with variable amounts of clay, silt and gravel. Cobbles and boulders should be expected within the glacial till.

Standard penetration tests carried out in the glacial till gave N values of 20 to greater than 50 blows per 0.3 metres of penetration, which reflect a variable, compact to very dense relative density. The higher N values may reflect the presence of cobbles and boulders within the glacial till.

The water content of tested samples of the glacial till ranged from about 9 to 14 percent.

4.2.7 Auger Refusal / Bedrock

Auger or Probehole refusal was not encountered within the depth of investigation along this section, which ranged from about 4.4 to 4.6 metres (or between elevations 59.5 to 61.9 metres).

4.2.8 Golder (2006) Borehole Logs, BH05-8 to BH05-12

Five boreholes identified as BH05-08 to BH05-12 from Golder (2006) were advanced along this section of the proposed forcemain.

The subsurface conditions in the Golder (2006) boreholes appear relatively consistent with those encountered by GEMTEC, except for the encountered auger refusal levels. Auger refusal and the inferred bedrock surface was encountered at boreholes BH05-8 to BH05-10 at depths of 2.1

to 2.7 metres below surface grade (elevations 56.2 to 61.3). Boreholes 5-11 and 05-12 were terminated at a depth of 3.7 metres without encountering auger refusal / bedrock.

Considering that GEMTEC did not encounter auger refusal within this portion of the alignment, it is possible that the auger refusal and fractured bedrock noted by Golder Associates consists of boulders present within the glacial till.

4.3 Laurier Street (Borehole 24-12 and Probehole 24-11)

4.3.1 Roadway Structure

Borehole 24-12 was advanced through the Laurier Street roadway. The roadway structure consisted of about 60 millimetres of asphaltic concrete overlying about 170 millimetres of grey, crushed sand and gravel with trace silt (base material), and 220 millimetres of brown sand and gravel with trace to some silt (subbase material).

4.3.2 Fill Material

At borehole 24-12 a layer of fill material was encountered below the roadway structure consisting of light brown silty sand with a thickness of about 0.8 metres. The fill material extends to a depth of about 1.2 metres.

4.3.3 Former Topsoil

A 150-millimetre-thick former topsoil layer was encountered below the fill material in borehole 24-12 at a depth of about 1.2 metres.

4.3.4 Silty Clay

A native deposit of silty clay was encountered below the former topsoil layer at borehole 24-12 at a depth of about 1.4 metres.

The silty clay has been weathered to a grey brown and red brown crust. The weathered silty clay has a thickness of about 1.4 metres and extends to a depth of about 2.8 metres.

Standard penetration tests carried out in the weathered silty clay gave N values of 11 and 15 blows per 0.3 metres of penetration, which reflect a stiff to very stiff consistency.

4.3.5 Glacial Till

A deposit of glacial till was encountered below the silty clay in borehole 24-12 at depth of 2.8 metres (elevation 62.1 metres).

The glacial till can be generally described as grey brown and grey silty sand and gravel with some clay. Cobbles and boulders should be expected within the glacial till.

Standard penetration tests carried out in the glacial till gave N values of 6 to 19 blows per 0.3 metres of penetration, which reflect a variable, loose to compact relative density.

4.3.6 Sand

A layer of grey coarse sand with some gravel was encountered at borehole 24-12 below the glacial till at a depth of about 4.6 metres below surface grade (elevation 60.3 metres).

A standard penetration test carried out in the sand gave an N value of 8 blows per 0.3 metres of penetration, which reflects a loose relative density.

Borehole 24-12 was terminated within the sand at a depth of 5.2 metres (elevation 59.6 metres).

4.3.7 Auger Refusal / Bedrock

Auger or Probe refusal was not encountered within the 5.2 metres depth of investigation along this section of the forcemain. The corresponding elevation is 60.2 metres.

4.3.8 Golder (2006) Borehole Logs, BH05-13 to BH05-15

3 boreholes identified as BH05-13 to BH05-15 from Golder (2006) were advanced along Laurier Street from the school entrance to the lagoon entrance.

The subsurface conditions in the Golder (2006) boreholes appear relatively consistent with those encountered by GEMTEC, with the exception of the encountered auger refusal at BH05-14. Auger refusal was encountered at borehole BH05-14 at a depth of 2.0 metres or elevation 62.9 metres. It is possible that the auger refusal noted by Golder Associates occurred because of boulders present within the glacial till, however coring was not carried out to confirm the cause of the refusal.

4.4 Lagoon (Boreholes 24-15 to 24-17 and Probehole 24-14)

4.4.1 Topsoil

The lagoon area boreholes were advanced through a surficial layer of topsoil ranging in thickness from 30 millimetres to 50 millimetres.

4.4.2 Fill Material

Fill material was encountered below the topsoil at all of the borehole locations. The fill material is variable but generally consists of sand with variable amounts of clay and gravel and containing trace amounts of organic material. The fill material has a thickness of about 1.8 to 5.1 metres at the borehole location. The fill material extends to depths of about 1.8 to 5.2 metres below surface grade (elevations 62.4 to 65.9 metres).

Grain size distribution tests were undertaken on samples of the fill material from borehole 24-15 and 24-17. The results are provided in Appendix C and are summarized in the Table 4.7.

The moisture content on samples of the fill material was found to range from about 12 to 38 percent – refer to the borehole logs for all test results in detail.

Table 4.7: Summary of Grain Size Distribution Results – Fill Material

Borehole & Sample ID	Depth (metres)	Clay (<2 µm) (%)	Silt (2 - 75 µm) (%)	Sand (75 µm - 5 mm) (%)	Gravel (5 - 80 mm) (%)	Water Content (%)
24-15 (SA2)	0.8 – 1.4	15	48	36	1	16
24-17 (SA1)	0.0 – 0.6	14 (combined clay & silt)		83	3	12

4.4.3 Sandy Silt

A 0.8-metre-thick layer of grey sandy silt was encountered at borehole 24-15 below the fill material at a depth of about 3.1 metres below surface grade (elevation 64.7 metres).

A standard penetration test carried out in the sandy silt gave an N value of 21 blows per 0.3 metres of penetration, which reflects a compact relative density.

The moisture content on a sample of the sandy silt was found to be about 19 percent.

4.4.4 Silty Clay

A native deposit of silty clay was encountered below the sandy silt layer at borehole 24-15 at a depth of about 3.8 metres below surface grade (elevation 64.0 metres), and below the fill material at boreholes 24-16 and 24-17 at depths of 5.2 and 1.8 metres below surface grade (elevations 62.4 and 65.9 metres, respectively).

The silty clay is grey brown, red grey brown, and grey in colour. The boreholes were terminated within the silty clay at depths of 4.4 to 6.7 metres below surface grade (elevations 60.9 to 63.3 metres).

Standard penetration tests carried out in the silty clay gave N values of 2 to 7 blows per 0.3 metres of penetration, which reflects a stiff to very stiff consistency.

A grain size distribution and an Atterberg limits test were undertaken on a sample of the silty clay from boreholes 24-17. The results are provided on the Record of Borehole Sheets in Appendix B and are summarized in the Tables 4.8 and 4.9.

The moisture content on samples of the silty clay was found to range from about 30 to 50 percent. The moisture content of the samples tested are generally below the measured liquid limit value, with the exception of the bottom sample from borehole 24-17.

Table 4.8: Summary of Grain Size Distribution Results – Silty Clay Deposit

Borehole & Sample ID	Depth (metres)	Clay (<2 µm) (%)	Silt (2 - 75 µm) (%)	Sand (75 µm - 5 mm) (%)	Gravel (5 - 80 mm) (%)
24-17 (SA4)	3.8 – 4.4	46	53	1	0

Table 4.9: Summary of Atterberg Limits Test Results

Borehole & Sample ID	Depth (metres)	Liquid Limit (%)	Plastic Limit (%)	Water Content (%)
24-17 (SA4)	3.8 – 4.4	46	20	50

4.4.5 Auger Refusal / Bedrock

Auger or Probe refusal was not encountered within the depth of investigation along this section of the forcemain which ranged from 4.4 to 6.7 metres. The corresponding range of elevation is from 60.9 to 63.4 metres.

4.4.6 Golder (2006) Borehole Log BH05-16

One borehole, identified as BH05-16 from Golder (2006) was advanced alongside the access road to the lagoon near Laurier Street.

The subsurface conditions in the Golder (2006) borehole consisted of a 0.3m thick layer of topsoil overlying silty sand which extended to a depth of about 1.6 metres. Below the silty sand, a deposit of firm, grey brown and red brown, becoming grey silty clay was encountered. The borehole was terminated within the grey silty clay at a depth of about 3.7 metres (elevation 62.4 metres).

4.5 Groundwater Level

The groundwater levels measured in the monitoring wells on August 7 and September 9, 2024, are summarized in Table 4.10. The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

The groundwater levels reported in Golder (2006) are summarised in Table 4.11 below.

Table 4.10: Groundwater Levels

Borehole ID	Location	Screened Material	Date	Groundwater Depth (mbgs[1])	Groundwater Elevation (masl[1])
MW24-1	Brisson Street (South End)	Silty Clay and Glacial Till	August 7, 2024 Sept. 9, 2024	2.4 1.6	59.6 60.4
24-4	Brisson Street (North End)	Bedrock	August 7, 2024 Sept. 9, 2024	0.9 0.9	57.3 57.3
24-10	School Entrance	Glacial Till	August 7, 2024 Sept. 9, 2024	1.0 1.8	64.4 63.6
24-16	Lagoon Access Rd	Fill Material and Silty Clay	August 7, 2024 Sept. 9, 2024	1.1 0.8	66.5 66.8
24-18	Pumping Station	Bedrock	August 7, 2024 Sept. 9, 2024	4.9 4.3	56.7 57.3

Note: 1. mbgs = metres below ground surface ; masl = metres above mean sea level, CGVD28

Table 4.11: Groundwater Levels – Golder (2006)

Borehole ID	Location	Screened Material	Date	Groundwater Depth (mbgs[1])	Groundwater Elevation (masl[1])
05-01	SPS	Bedrock	December 3, 2005	1.5	59.3
05-02	SPS	NA – borehole observation	November 8, 2005	2.7	57.4
05-03	SPS	NA – borehole observation	November 9, 2005	2.5	58.3
05-06	Brisson Street (North End)	NA – borehole observation	November 9, 2005	0.9	57.5
05-07	Brisson Street (North End)	NA – borehole observation	November 10, 2005	0.6	57.6

Borehole ID	Location	Screened Material	Date	Groundwater Depth (mbgs[1])	Groundwater Elevation (masl[1])
05-08	Fields before school entrance	NA – borehole observation	November 10, 2005	0.2	58.1
05-09	Fields before school entrance	Silty Clay	December 3, 2005	frozen	frozen
05-13	School Entrance	Glacial Till	December 3, 2005	0.9	64.5
05-15	Lagoon Access Rd	Glacial Till	December 3, 2005	1.2	63.1

Note: 1. mbgs = metres below ground surface ; masl = metres above mean sea level, CGVD28

4.6 Hydraulic Conductivity

The results of the hydraulic testing carried out in the well screens are provided in Appendix D. A summary of the recovery measurements made during the bail down tests in the monitoring wells is provided in Table 4.12.

Table 4.12: Summary of Bail Down Test Results

Borehole ID	Geological Material Screened	Static Groundwater Depth (mbgs[1])	Estimated Groundwater Level Decrease (metres)	Recovery Time (minutes)	Recovery (percent)
MW24-1	Silty Clay / Glacial Till (Silty Sand)	2.42	0.33	10	100
24-4	Bedrock	0.88	3.62	660	22
24-10	Glacial Till (Silty Sand)	1.83	2.44	64	95
24-16	Fill Material / Silty Clay	0.80	1.89	735	99
24-18	Bedrock	4.26	0.82	5.5	100

Note: 1. mbgs = metres below ground surface

Hydraulic conductivities were calculated using the Hvorslev method of analysis on the well response data and are summarized in Table 4.13. The static water level was above the screen in all wells except MW24-1, wherein the static water level was within the filter pack of the well at the time of testing. To compensate for potential filter pack effects, the Bower and Rice (1976) correction was used, with an assumed effective porosity for the filter pack of 0.3.

The recovery in well 24-4 over the monitoring period was too small for a meaningful analysis; more detailed hydraulic conductivity analyses focused on wells MW24-1, 24-10, 24-16, and 24-18, as presented in Appendix D. The dual slope behaviour noted in some wells (i.e., MW24-01, 24-10, and 24-16) is suspected of being a product of the non-instantaneous well bailing/purging methodology and the filter pack. Where uncertainty in the analyses of the well response behaviour was identified, the more conservative interpretation of the results was adopted (e.g., the late time slope was analysed in MW24-01) to produce more conservative dewatering recommendations.

Table 4.13: Calculated Hydraulic Conductivities

Borehole ID	Geological Material Screened	Hydraulic Conductivity, k (m/s)
MW24-1	Silty Clay / Silty Sand (Glacial Till)	2×10^{-5}
24-4	Bedrock	$\leq 10^{-8}$ (estimated)
24-10	Silty Sand (Glacial Till)	1×10^{-6}
24-16	Silty Sand (Fill) / Silty Clay	2×10^{-7}
24-18	Bedrock	1×10^{-5}

The calculated hydraulic conductivities range from $\leq 10^{-8}$ (estimated) to 2×10^{-5} m/s. The most conductive units are anticipated to be the sandy glacial till, coarse fill (if present), and/or areas of fractured bedrock. The differences in hydraulic conductivity of the wells screened in bedrock are interpreted to be associated with differences in secondary porosity at the locations and depths tested. Literature values (Freeze & Cherry, 1979) for glacial till range from 10^{-6} to 10^{-12} m/s and for silty clay from 10^{-9} to 10^{-6} m/s.

Golder Associates Limited (2005) prepared a report title “Application for a Permit to Take Water for Construction Excavation Dewatering, Sewage Pumping Station Expansion and Upgrade, Casselman, Ontario”, wherein they performed rising head tests in a well screened across the upper bedrock near the existing sewage pumping station. They reported that the hydraulic conductivity of the bedrock was between 3.3×10^{-6} and 6.9×10^{-6} m/s. Furthermore, they provided estimates based on professional experience for the fill and glacial till of 1×10^{-5} and 1×10^{-7} m/s, respectively. The hydraulic conductivities proposed by Golder Associates Limited (2005) are in general agreement with those calculated in this report.

4.7 Groundwater Quality

The groundwater quality analytical results are included in Appendix E. No parameter limits associated with a local sewer-use by-law was identified for Casselman, so the results were compared against the following for consideration: the City of Ottawa Sewer Use By-law (No. 2003-

514), Provincial Water Quality Objectives (PWQO), and the Site Conditions Standards Table 2: Potable Groundwater Environment (O. Reg. 153/04). General inorganics, total and filtered metals, volatiles and semi-volatiles were resampled after further well development, due to high sediment loads in the first rounds of samples, and where re-sampling data is available the most recent results for these parameters are considered in the discussion of exceedances below (included in Appendix E):

Ottawa Sewer Use By-law – Storm Sewers:

- Total suspended solids (TSS) of 142 mg/L exceeded the limit of 15 mg/L at well 24-16;
- Manganese concentration in the filtered and unfiltered samples exceeded the limit of 0.05 mg/L at wells 24-16 and 24-18; and
- Toluene concentration of 0.0183 mg/L exceeded the limit of 0.002 mg/L at well 24-16.

Ottawa Sewer Use By-law – Sanitary and Combined Sewers:

- Manganese concentration in the filtered and unfiltered samples exceeded the limit of 5 mg/L at well 24-16. This concentration may be associated with elevated sediments or the proximity of the test hole to the sewage lagoon.

Provincial Water Quality Objectives (for discharge to be received by surface water features):

- Total phosphorous concentrations exceeded the PWQO in the samples collected from wells 24-16 and 24-18. Total phosphorous concentrations were shown to decrease below the PWQO following filtration of both well samples, suggesting that these exceedances are likely to be mitigated with the removal of suspended sediments.
- Cobalt concentration in the filtered and unfiltered samples exceeded the PWQO of 0.0009 mg/L at well 24-16.
- Toluene concentration of 0.0183 mg/L exceeded the PWQO of 0.0008 mg/L at well 24-16.
- Aluminum concentration in clay-free samples (filtered) exceeded the PWQO of 0.075 mg/L at well 24-16.

Site Conditions Standards Table 2: Potable Groundwater Environment (for discharge to the environment):

- Cobalt concentration in the filtered and unfiltered samples exceeded the limit of 0.0038 mg/L at well 24-16; and
- Vanadium concentration in the unfiltered samples exceeded the limit of 0.0062 mg/L at well 24-16 but fell below the limit following filtration.

The water quality at BH24-16 had exceedances of toluene, manganese, cobalt, and aluminum. Its distinct water quality may be indicative of degraded water quality due to its proximity to the sewage lagoon. These exceedances will need to be considered by the Qualified Person when considering discharge options and may require further investigation.

Which regulations are applicable will depend on the discharge receiver(s) (e.g., surface water, ground surface for infiltration, storm sewer, and/or sanitary sewer). Approval from the Municipality of Casselman must be granted for discharges of groundwater to sewer systems within the municipality.

4.8 Groundwater Chemistry Relating to Corrosion

The results of chemical testing on groundwater samples recovered from boreholes 24-4, 24-10, 24-16, and 24-18 are provided in Appendix E and summarized in Table 4.14.

Table 4.14: Summary of Corrosion Testing - Groundwater

Parameter	Borehole 24-4	Borehole 24-10	Borehole 24-16	Borehole 24-18
Chloride Content (mg/L)	31	224	21	493
Resistivity (Ohm·m)	12.0	6.61	7.5	3.85
pH	8.1	8.2	6.6	7.6
Sulphate Content (mg/L)	36	87	1	93

5.0 RECOMMENDATIONS AND GUIDELINES - PIPELINES

5.1 Excavation

Based on the results of the investigation, together with the planned excavation depth, the overburden excavations for the proposed pipelines will be carried out through zones of existing pavement structures, fill material, former topsoil, sand, silty clay, and glacial till. Based on the results of the boreholes, bedrock excavation will be required along Brisson Street (unless the existing pipe trench excavation is reused). Some bedrock excavation may also be required at the SPS, depending on the depth of excavation proposed at this location (which has not been finalised at the time of preparing this report).

5.1.1 Overburden Excavation

The sides of the excavations within overburden soils should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, most of the soils at this site can be classified as Type 3 soils. Therefore, for design purposes, allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes for soils above the groundwater level. Sands below the groundwater level would be

classified as Type 4 soils and in such conditions 3 horizontal to 1 vertical excavation sides slopes would be required in such conditions.

As an alternative or where space constraints dictate, installation of the pipelines could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose. It is noted that some unavoidable inward horizontal movement and settlement of the ground behind the trench box should be anticipated, which could affect existing services located behind the trench box. Additional information on impacts to adjacent services is provided in Section 5.3.

Based on the measured groundwater levels and anticipated invert elevation, excavation will extend below the measured groundwater levels along the new forcemain alignment. Excavation of the overburden deposits above the groundwater level should not present significant constraints. Below the groundwater level, sloughing of the sand and silt material, and glacial till into the excavation should be anticipated along with disturbance to the native soils in the bottom of the excavation. It is anticipated that all of the excavation works will be feasible from a trench box.

In areas where glacial till is encountered cobbles and boulders should be anticipated in the glacial till which may lead to increased excavation effort and slower progress. As such, allowance should be made for removal of boulders from the glacial till during excavation. In order to advance the trench box, even boulders that partially intrude into the sides of the excavation must be removed, which may result in a wider excavation than anticipated.

5.1.2 Bedrock Excavation

Localized bedrock removal to shallow depths at this site (Brisson Street) could be carried out using hoe ramming techniques in conjunction with line drilling on close centres. Due to the proximity of existing structures and services, it is suggested that allowance be made for line drilling 75- to 100-millimetre diameter holes on 200-to-300-millimetre centres to limit the horizontal overbreak of the bedrock. It is noted, based on observations during drilling and local experience, that the bedrock contains horizontal bedding planes and likely also near vertical joints. Therefore, some horizontal and vertical overbreak should be expected. Allowance should be made for additional granular material below the services in bedrock excavations.

For deeper excavations in the bedrock (if required, noting that the design of the works at the SPS are under development) drill and blasting could be carried out. However, based on the bedrock quality encountered up to a depth of about 6 metres, the bedrock excavation could possible be undertaken using hoe ramming techniques in conjunction with line drilling on close centres – at slower excavation rates. It should be noted that this technique may require significant effort, and the bedrock quality should be assessed by the contractor.

The vibration effects of hoe ramming are usually minor and localized. Any blasting should be controlled to limit the peak particle velocities in order to avoid blast induced damage and, any blasting should be carried out under the supervision of a blasting specialist engineer. The peak

vibration limits provided in Table 5.1 are suggested as a guide. It is pointed out that these criteria, although conservative, were established to prevent damage to existing buildings and services that are in good condition; more stringent criteria may be required to prevent damage to freshly placed (uncured) concrete or vibration sensitive equipment or utilities. Monitoring should be carried out to ensure that the excavation activities meet the limiting vibration criteria. Pre-construction condition surveys of nearby structures and existing buried services should be carried out so that any claims can be dealt with in a fair manner.

Fractured bedrock and/or weathered bedrock should be excavated using 1 horizontal to 1 vertical, or flatter, side slopes. Sound bedrock may be excavated with near vertical sidewalls. Any loose bedrock should be scaled from the sides of the excavation.

Table 5.1: Peak Vibration Limits

Frequency of Vibration (Hz)	Vibration Limits (millimetres/second)
<10	5
10 to 40	5 to 50 (interpolated)
>40	50

5.1.3 Excavation Adjacent to Existing Services

As previously indicated, some unavoidable inward horizontal movement and settlement of the ground behind the trench box should be anticipated, which could affect existing services located in this zone of movement. As such, we recommend that the excavations not encroach within a line extending downwards and outwards at an inclination of 1 vertical to 2 horizontal from the base of the existing services (i.e., sewers, watermains).

Where the recommended separation distance is not possible, a 1 horizontal to 1 vertical encroachment zone between the horizontal excavation extent and the base of the existing service is acceptable provided that the contractor's construction methodology is observed at the beginning of construction. Temporary intrusion within this zone is also acceptable provided that all measures to mitigate movement of the excavation sides slopes are undertaken (ex. filling space between trench box and excavation with sand, ensuring adequate compaction of all fill materials within encroachment zone, etc.). Field directions should be provided as required based on field conditions to ensure that the base of the adjacent services and the supporting soil are not compromised. Site visits by geotechnical personnel should be carried out daily where excavation is required within the 1 vertical to 2 horizontal zone described above.

5.2 Construction Dewatering and Drainage

Groundwater inflow into trench excavations could likely be handled by pumping from within the excavations using sump pumps – noting that:

- Variability in groundwater inflows may be encountered due to heterogeneity in fill and till composition. Inflows may potentially diminish with time once storage is depleted.
- Zones of higher permeability bedrock may be encountered at bedrock surface and also with depth and groundwater inflow may be more significant in these zones, and
- Bedrock removal may change the rock mass properties (particularly if drill and blasting is carried out) which can increase groundwater inflows.

Any sump pumps should be installed in perforated casings surrounded by graded granular sand to reduce the potential for loss of fines into the sump. Filter cloth / geotextile may be considered to further reduce sediment uptake into the sump pump.

Where possible, excavation works should be scheduled for the drier parts of the year – and relatively small test excavations could be opened to assess dewatering requirements initially and if necessary, pumping could be carried out in advance of site wide excavations to lower the groundwater level.

It is suggested that an excavation and groundwater management plan be submitted for review and approval as part of the contract. The plan should be prepared by a specialist dewatering contractor, using a methodology based on their own assessment of site conditions, the proposed construction approach, and on their experience and equipment.

5.2.1 Effects of Temporary Groundwater Lowering

Based on the results of the investigation, it is not expected that short-term pumping during excavation will have a significant effect on nearby structures and services.

5.2.2 Water Taking Permits and Registrations

This section presents a preliminary evaluation of dewatering needs to inform recommendations regarding water taking permits and registrations. Groundwater takings less than 50,000 litres per day do not need a permit. Conversely, water takings above 50,000 but below 400,000 litres per day will require an Environmental Activity and Sector Registry (EASR), and water takings in excess of 400,000 litres per day will require a Category 3 Permit to Take Water (PTTW). Water takings from multiple water taking sources (e.g., wells, surface water features, or excavations) are only considered cumulatively for permitting purposes when their drawdown areas of influence are overlapping.

It has been assumed that excavations down to a maximum of about four metres below ground surface for the sanitary sewer infrastructure. These assumed excavation depths will extend below

the measured groundwater levels, necessitating groundwater management to support construction.

For the purposes of estimating groundwater inflow volumes, it was assumed that the excavations will be completed in 30-metre-long sections that are 4.5 metres wide. Calculations were completed using groundwater levels of 0.6 metres below ground surface and the highest calculated hydraulic conductivity of 2×10^{-5} m/s.

Based on the intended works proposed, assumed conditions, the possibility of precipitation and snowmelt, and the incorporation of a three times safety factor, groundwater inflows are estimated to exceed 50,000 litres per day but remain below 400,000 litres per day for a single open excavation. Accordingly, an EASR registration is likely sufficient for the construction dewatering associated with the proposed works. An EASR registration requires a Qualified Person to prepare a Water Taking and Discharge Plan report, which will consider the groundwater taking volumes and discharge options.

It should be noted that the conductivity and connectivity of fractures/discontinuities, fill, and glacial till deposits across the site is uncertain, and water levels during construction could be higher than those presented herein. These dewatering estimates should be reviewed by a Qualified Person once detailed design drawings are available.

5.3 Pipe Bedding

The pipe bedding material should consist of well graded crushed stone meeting OPSS requirements for Granular A. The minimum bedding thickness should be 150 millimetres for excavation within overburden. The granular materials used in the service trenches should be composed of virgin (i.e., not recycled) material only.

Saturated native deposits of silty clay and/or glacial till will likely be encountered at subgrade level along the proposed forcemain alignment. These deposits are susceptible to weakening under vibration and/or repeated loading and it is suggested that final trimming to subgrade level be carried out using a hydraulic shovel equipped with a flat blade bucket. We recommend that a contingency allowance be made in the contract for a 300-millimetre thick subbedding layer of OPSS Granular B Type II granular material and a woven geotextile meeting OPSS 1860 Class II requirements in the event that the subgrade soils are disturbed during construction.

Where boulders are encountered at subgrade level some over-excavation may occur, and additional bedding material may be required to fill any voids left following the removal of boulders. Where subexcavation occurs, the material should be replaced with OPSS Granular B Type II granular material.

The use of clear crushed stone as bedding or subbedding material should not be permitted.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A.

The subbedding, bedding and cover materials should be compacted in maximum 300-millimetre-thick lifts to at least 95 percent of the standard Proctor dry density value.

5.4 Trench Backfill

The backfill materials within the zone of seasonal frost penetration (i.e., 1.8 metres below finished grade) should match the materials exposed on the trench walls. This will reduce the potential for differential frost heaving between the area over the trench and the adjacent areas. The above is recommended when working in access roads and areas where differential frost heaving is a concern. In landscaped areas or where differential frost heave is not a concern, it is not necessary for the backfill material to match the materials exposed on the trench walls.

Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I or II, or imported OPSS Select Subgrade Material. Any organic soils or topsoil, if encountered, should be wasted from the excavation.

To minimize future settlement of the backfill and achieve an acceptable subgrade for any roadways, curbs, etc., the trench backfill should be compacted in maximum 300-millimetre-thick lifts to at least 95 percent of the standard Proctor dry density value. In landscaped areas, and where some settlements are permissible, the backfill could be compacted in maximum 300-millimetre-thick lifts to at least 90 percent of the standard Proctor dry density value.

The deeper deposits of silty clay and glacial till may have a moisture content that is too high for compaction. Furthermore, these materials are sensitive to changes in moisture content due to precipitation. As such, the specified densities may not be possible to achieve, and, as a consequence, some settlement of these backfill materials could occur. Consideration could be given to implementing one or a combination of the following measures to reduce post construction settlement above the trenches, depending on the weather conditions encountered during the construction:

- Allow the overburden materials to dry prior to compaction;
- Reuse any wet materials in the lower part of the trenches and make provision to defer hard surfacing (i.e., paving, concrete, etc.) for 3 months, or longer, to allow the trench backfill settlement to occur and thereby improve the final appearance of the hard surfacing.
- Avoid reusing any wet material within the trench. If additional material is required for trench backfill, consideration could be given to using imported, relatively dry, earth fill material within the zone of frost penetration, and granular material conforming to OPSS

Granular B Type I or II or imported OPSS Select Subgrade Material below the zone of frost penetration. The frost susceptibility of the earth fill should be assessed prior to use for frost compatibility with the material on the sides of the trench.

5.5 Seepage Barriers

To prevent the granular bedding in the services trench from acting as a “French Drain” and thereby resulting in excessive groundwater lowering, seepage barriers should be installed along the service trenches. The seepage barriers should begin at subgrade level and extend vertically through the granular pipe bedding and granular surround to within the native backfill materials, and horizontally across the full width of the service trench excavation. The seepage barriers could consist of 1.5-metre-wide dykes of compacted silty clay. The silty clay should be compacted in maximum 300-millimetre-thick lifts to at least 95 percent of the standard Proctor dry density value.

Based on the project extents, seepage barriers should be placed at the project limits along the roadways (outside of the intersection) at Brisson Street and Laurier Street, at the project limits of the field, and the project limits in the area of lagoon. Between the project limits, seepage barriers should be placed at a spacing of 80 metres along the proposed alignments.

5.6 Corrosion of Buried Concrete and Steel

The measured sulphate concentration from the groundwater samples recovered from the monitoring wells in 24-4, 24-10, 24-16, and 24-18 range from 1 to 93 mg/L. According to Canadian Standards Association (CSA) “Concrete Materials and Methods of Concrete Construction”, the sulphate concentration in the groundwater is considered low. Therefore, any concrete in contact with the native soil and groundwater could be batched with General Use (GU) cement. The effects of freeze thaw in the presence of de-icing chemicals (sodium chloride) use on the roadway should be considered in selecting the air entrainment and the concrete mix proportions for any concrete.

Based on the resistivity, pH, and the measured chloride content of the groundwater samples tested, the groundwater and native soils can be classified as slightly aggressive to aggressive towards unprotected steel. It is noted that the corrosivity of the soil/groundwater could vary throughout the year due to the application of sodium chloride for de-icing.

5.7 Winter Construction

Most of the soils at this site are highly frost susceptible and are prone to significant ice lensing. In order to carry out the work during freezing temperatures, the service trenches should be opened for as short a time as practicable and the excavations should be carried out only in lengths that allow all of the construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the trenches should not be allowed to freeze. In addition, the backfill should be excavated, stored and replaced without being disturbed by frost or contaminated by snow or ice.

5.8 Seismic Site Classification

The seismic Site Class in the vicinity of the existing pump station is Site Class C (very dense soil and soft rock), based on the presence of stiff to very stiff silty clay over glacial till over relatively shallow bedrock. Refer to boreholes 24-1 to 24-4, and 24-18.

In the vicinity of the lagoon area where a seismic Site Class assessment is also required Site Class C is likely also applicable, based on the findings of borehole 05-15 from Golder (2006) in which reasonably shallow glacial till (which typically overlies bedrock) was encountered. However, the borehole is located about 150 metres from the point of interest.

6.0 ROADWAY RECONSTRUCTION

6.1 Subgrade Preparation

It is understood full road width reconstruction is being considered along Brisson Street, and that trench reinstatement of the roadway is being considered along Laurier Street, the access road to the Sainte-Euphémie Catholic Elementary School, and the lagoon access road.

Prior to placing granular material, the subgrade surfaces should be proof rolled with an 8-tonne or larger steel drum roller under dry conditions. Any soft areas should be subexcavated and replaced with suitable, compacted earth borrow that is similar to that exposed in adjacent subgrade areas.

6.2 Pavement Design (Brisson)

Traffic volumes are not available at the time of this report. However, based on the use of the roadway, it is expected that vehicle types will consists primarily of light vehicles accessing the residences on Brisson Street and the future Brisson Waterfront Rehabilitation Project. Occasional heavy vehicle use associated with the Laplante Generating Station should be expected.

The following minimum pavement structure may be used for the full depth reconstruction of Brisson Street:

- 40 millimetres of Superpave 12.5 Traffic Category B, PG 58-34, over
- 50 millimetres of Superpave 12.5 Traffic Category B, PG 58-34
- 150 millimetres of OPSS Granular A; over,
- 450 millimetres of OPSS Granular B Type II.

The proposed full depth reconstruction will provide a new SN of approximately 108 millimetres which should perform under the anticipated loading on Brisson Street, in the absence of detailed traffic data.

6.3 Trench Reinstatement (School Access, Laurier Street, Lagoon Access Road)

It is understood that the proposed pipelines will cross the school access road, possibly along a portion of Laurier Street, and along the lagoon access road. The current investigation was limited due to the unlocatable forcemain and as such, no information on the existing lagoon access road structure is available, but it is confirmed that the access road is gravel surfaced. The Golder borehole logs do not provide any details on the lagoon access road either. As such, the following roadway structures are provided:

6.3.1 School Access Road

Typically, school access roads are designed to support heavy vehicle traffic (busses, fire trucks). Based on the existing structure encountered in borehole 24-10, this appears to be consistent. As such, the following pavement structure is recommended at the school:

- 100 millimetres of asphaltic concrete, comprising:
  - 50 millimetres of Superpave 12.5, Traffic Level B, PG 58-34; over,
  - 50 millimetres of Superpave 12.5, Traffic Level B, PG 58-34
- 150 millimetres of OPSS Granular A (Base); over,
- 450 millimetres of OPSS Granular B Type II (Subbase).

Alternatively, if the use of an additional mix is feasible to the project constraints, the following pavement structure may be considered at the school:

- 100 millimetres of asphaltic concrete, comprising:
  - 40 millimetres of Superpave 12.5, Traffic Level B, PG 58-34; over,
  - 60 millimetres of Superpave 19, Traffic Level B, PG 58-34
- 150 millimetres of OPSS Granular A (Base); over,
- 450 millimetres of OPSS Granular B Type II (Subbase).

6.3.2 Laurier Street

Based on the pavement structure encountered at borehole 24-12, the following pavement structure could be used to reinstate the trench along Laurier Street:

- 90 millimetres of asphaltic concrete, comprising:
  - 40 millimetres of Superpave 12.5, Traffic Level C, over
  - 50 millimetres of Superpave 12.5, Traffic Level C, over
- 150 millimetres of OPSS Granular A (Base); over,
- 450 millimetres of OPSS Granular B Type II (Subbase).

The above pavement structure is thicker than that encountered in the borehole, but is recommended as a minimum for the type of roadway. Should it be preferable to use Superpave

19.0 for the base layer of the asphalt the thickness of the layer should be increased to 60 millimetres (to avoid possible issues with compaction of the layer).

6.3.3 Lagoon Access

As previously noted, no information is available on the gravel structure of the lagoon access. It is recommended that the roadway structure be reinstated as found at the time of construction. For project costing purposes, the following roadway structure should be used:

- 200 millimetres of OPSS Granular A (Base); over,
- 400 millimetres of OPSS Granular B Type II (Subbase).

Based on a recent project, it is understood that Marshall Mixes are typically employed by the Municipality of Casselman. As such, the asphaltic concrete layers could be substituted directly for HL3 (wear course) and HL8 (base course).

6.4 Effects of Soil Disturbance and Construction

The pavement structures provided above assumes that the roadway subgrade surface is properly prepared and proof rolled at the time of construction (i.e., the subgrade is not disturbed or wetted due to construction operations or precipitation). If the roadway subgrade surface becomes disturbed or wetted due to construction operations or precipitation, the Granular B Type II thicknesses provided above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or place a geotextile over the subgrade surface.

The required thickness of the subbase materials will depend on a number of factors, including schedule, contractor methodology, soil types and weather conditions, and should be assessed by geotechnical personnel at the time of construction. In our opinion, the preferred approach from a geotechnical point of view is to:

- Proof roll the subgrade at the time of construction under the supervision of experienced geotechnical personnel.
- Adjust the thickness of the subbase material and include a woven geotextile, as required. Unit rate allowances should be made in the contract for a geotextile (woven, OPSS1860 Type II) and subexcavation and replacement with OPSS Granular B Type II.

6.5 Compaction Requirements

All imported granular materials for the roadway structure should be placed in maximum 200-millimetre-thick lifts and should be compacted to at least 98 percent of the standard Proctor dry density value using suitable vibratory compaction equipment.

6.6 Pavement Drainage (Brisson Street)

Adequate drainage of the pavement granular materials and subgrade is important for the long-term performance of the pavement at this site. The granular base and subbase materials should extend horizontally to the adjacent ditches/swales. Where possible, the bottom of the swales/ditches should be at least about 0.3 metres below the bottom of the Granular B Type II.

6.7 Pavement Transitions

As part of the roadway reinstatement, the new pavements will abut existing pavements. The following is suggested to improve the performance of the joint between the new and the existing pavements:

- Neatly saw cut the existing asphaltic concrete;
- Remove the asphaltic concrete and slope the bottom of the excavation within the existing granular base and subbase at 3 horizontal to 1 vertical, or flatter, to avoid undermining of the existing asphaltic concrete and provide a gradual transition between the new and existing granular materials.
- Remove (mill off) 40 to 50 millimetres of the existing asphaltic concrete (to match the thickness of the wear course asphaltic concrete) to a distance of 300 millimetres at the joint and tack coat the asphaltic concrete at the joint in accordance with the requirements in OPSS 310.

Notwithstanding the above, based on our experience, there will likely be some unavoidable reflective cracking of the asphaltic concrete at the joint.

6.8 Comments on Slope Stability – SPS

Excavations to the north of the PSP will be carried out into the sloping ground towards the South Nation River. GEMTEC has not carried out a stability assessment of the existing slopes.

The long-term effects of the permanent works are not anticipated to cause significant additional loading to the slopes. However, erosion can occur where flow from pipe outflows occurs and measures to protect the slopes from increased erosion should be considered.

To address short term conditions during construction, the following conditions could be applied to the tender documentation as a cautious approach;

- Materials should not be stockpiled on the ground surface within about 10 metres of the top of slope.
- Trenches should remain open for the minimum time practically possible. It is recommended that trenches are not left open for instance over the weekend or days where construction works are not being carried out.

- During inclement weather, infiltration of water into the trench should be minimised using tarps or other means
- Surface water should be directed away from the trench, while open and while backfilled until a vegetated surface is restored such that infiltration of water into the trench and soils below is minimized.
- Where possible, only light compaction equipment should be used for the works.
- The contractor shall retain a geotechnical firm to confirm that the proposed equipment and construction methodology will not adversely impact the stability of the slopes.

Vegetative cover, which includes the reinforcing effects of root systems has been identified as a significant influencing factor in the stability of slopes. Removal of existing vegetation should be avoided wherever possible, and any cleared sections should be revegetated as soon as possible.

7.0 ADDITIONAL CONSIDERATIONS

7.1 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source but may be felt at nearby structures. The magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition. Precondition surveys of the adjacent structures should be considered so that any claims can be reasonably addressed.

7.2 Monitoring Well Abandonment

All monitoring wells installed as part of this investigation should be decommissioned by a licensed well technician in accordance with Ontario Regulation 903, as amended by Ontario Regulation 128/03. The well abandonment could be carried out in advance or during construction.

8.0 CLOSURE

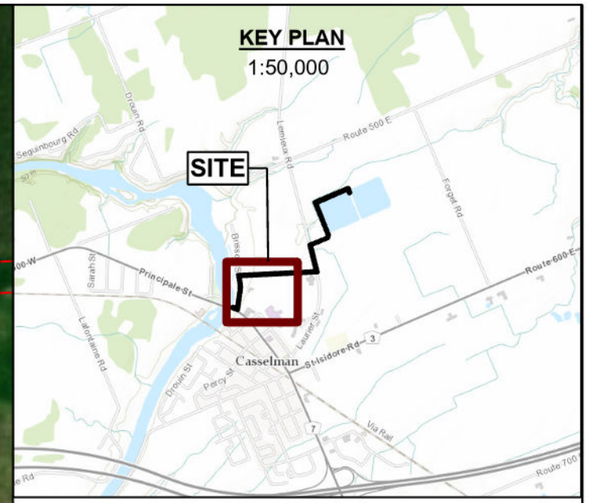
We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Luc Bouchard, P.Eng., ing.
Geotechnical Engineer

LB/JKA/DC/DE/AB

APPENDIX A

Borehole Location Plan, Figure A1 to A3



LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE LOCATION

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N
2. Survey Reference based on PRS579626392983
   Easting: 476040.80m
   Northing: 5012925.07m
   Elevation: 78.42m
2. Geographic dataset source: Ontario GeoHub.
3. Contains information licensed under the Open Government Licence – Ontario.
4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:
1:2,000 Meters
0 27.5 55 110 165

Drawing
SOIL EXCEEDANCES

Client:
J. L. RICHARDS & ASSOCIATES LIMITED

Project
CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	L.B.
Project No.	100117.051	Revision No.	0
Date	DECEMBER 2024		**FIGURE A1**

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ottawa@gemtec.ca

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KEY PLAN
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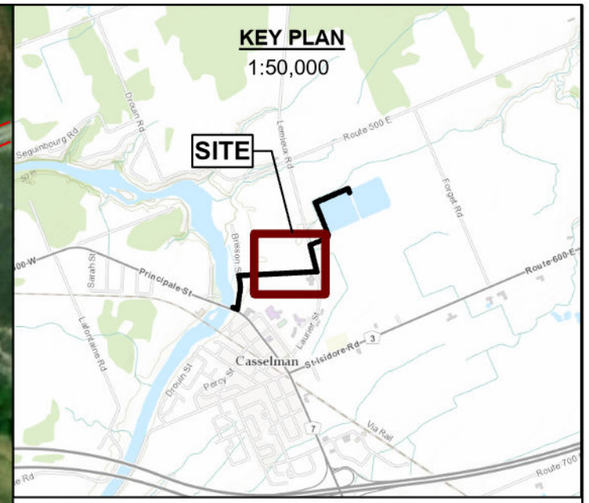

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE LOCATION

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N
2. Survey Reference based on PRS579626392983
   Easting: 476040.80m
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2. Geographic dataset source: Ontario GeoHub.
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Scale:
1:2,000 Meters
0 27.5 55 110 165

Drawing
BOREHOLE LOCATION PLAN

Client:
J. L. RICHARDS & ASSOCIATES LIMITED

Project
CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	L.B.
Project No.	100117.051	Revision No.	0
Date	DECEMBER 2024		**FIGURE A2**

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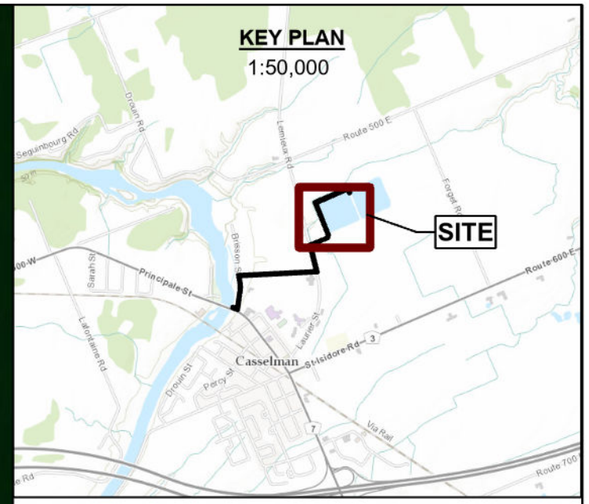

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N
2. Survey Reference based on PRS579626392983
   Easting: 476040.80m
   Northing: 5012925.07m
   Elevation: 78.42m
2. Geographic dataset source: Ontario GeoHub.
3. Contains information licensed under the Open Government Licence – Ontario.
4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:

1:2,000 Meters

0 27.5 55 110 165

Drawing: BOREHOLE LOCATION PLAN

Client: J. L. RICHARDS & ASSOCIATES LIMITED

Project: CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	L.B.
Project No.	100117.051	Revision No.	0
Date	DECEMBER 2024		**FIGURE A3**

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APPENDIX B

Record of Borehole Sheets
List of Abbreviations and Symbols

RECORD OF BOREHOLE 24-1

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		61.93						Asphaltic coldpatch repair
		28mm ASPHALTIC CONCRETE		0.03						
		Grey, crushed sand and gravel, trace silt (BASE/SUBBASE MATERIAL)		61.51						
		Stiff to very stiff, red grey brown SILTY CLAY		0.42	1	SS	250	16		
1					2	SS	400	9		
				60.41						
		Very stiff, grey brown SILTY CLAY, trace sand		1.52	3	SS	500	14	MH	Backfilled with auger cuttings
2					4	SS	350	14		
				58.88						
3		Dense to very dense, brown silty sand, trace clay and gravel (GLACIAL TILL)		3.05	5	SS	350	34		
				58.12						
4		End of Borehole Auger refusal		3.81						
5										
6										
7										
8										
9										
10										

SOIL PROFILE
SAMPLES
PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA
NATURAL
REMOULDED
WATER CONTENT, %
W_P W W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-2

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		59.21						Asphaltic coldpatch
0	Power Auger Hollow Stem Auger (210mm OD)	Grey, crushed sand and gravel, trace silt (ROADWAY MATERIAL)		0.20						
		Brown silty sand and gravel, trace clay (FILL MATERIAL)			1	SS	300	26		
1					2	SS	200	16		Backfilled with auger cuttings
		Stiff to very stiff, grey brown SILTY CLAY		57.99 1.22						
2					3	SS	450	7		
		Grey silty sand and gravel, trace clay (GLACIAL TILL)		56.92 2.29	4	SS	75	50 for 75mm		
	Diamond Rotary Core HQ (89mm OD)	BEDROCK		56.67 2.54	5	RC		TCR= 77%, SCR=77%, RQD= 77%	UC= 84.8 MPa	
3										Bentonite seal
4					6	RC		TCR= 94%, SCR=89%, RQD= 79%		
		End of Borehole		54.81 4.40						
5										
6										
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-3

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 19 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		58.60							
		Grey, crushed sand and gravel (ROADWAY MATERIAL)		0.20							Asphaltic coldpatch repair
1		Grey gravel, some sand (FILL MATERIAL)		57.42							Backfilled with auger cuttings
		Stiff to very stiff, grey brown SILTY CLAY		1.18							
2		End of Probe Hole Auger Refusal		56.75 1.85							
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-4

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 19 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger (210mm OD)	Ground Surface		58.26							Flush Mount Casing and sand
		Grey, crushed sand and gravel (ROADWAY MATERIAL)		57.60	1	SS		41			
1	Diamond Rotary Core HQ (89mm OD) Hollow Stem Auger	BEDROCK		0.66	2	RC		TCR= 89%, SCR= 68%, RQD= 48%			Bentonite Seal
2					3	RC		TCR= 93%, SCR= 91%, RQD= 91%			
3					4	RC		TCR= 99%, SCR= 99, RQD= 92%		UC= 65.4 MPa	Filter Sand
4					5	RC		TCR= 100%, SCR= 89%, RQD= 89%			50mm diameter, 1.5m long PVC screen
5		End of Borehole		53.38 4.88							
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
24/08/07	0.9 ▽	57.3

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-6

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 25 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		63.91						
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.03						Asphaltic coldpatch repair
		Stiff to very stiff, grey brown SILTY CLAY			1	SS	450	3		
1					2	SS	500	12		
2					3	SS	610	10		Backfilled with auger cuttings
				61.32	4	SS	425	21		
		Compact to very dense, grey brown gravelly silty sand, some clay, possible cobbles and boulders (GLACIAL TILL)		2.59						
3					5	SS	125	50 for 75mm		
4					6	SS	350	28	M	
				59.49						
		End of borehole		4.42						
5										
6										
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % (W, W_P, W_L)
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-7

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 25 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L); 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		64.35							Asphaltic coldpatch repair
		Probe Hole - Soil not sampled									
1											
2											Backfilled with auger cuttings
3											
4				59.77							
		End of Probe Hole		4.58							
5											
6											
7											
8											
9											
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-8

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 25 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		65.76							
		TOPSOIL		0.05							Asphaltic coldpatch repair
		Grey brown silty clay, trace sand (FILL MATERIAL)			1	SS	350	2			
1				64.69	2	SS	400	3			
		FORMER TOPSOIL LAYER		1.07							
		Stiff to very stiff, grey brown SILTY CLAY		1.10							
2					3	SS	610	8			Backfilled with auger cuttings
					4	SS	610	9			
				63.01							
3		Compact to very dense, grey brown silty sand, some clay and gravel, possible cobbles and boulders (GLACIAL TILL)		2.75	5	SS	400	32			
4					6	SS	450	52			
				61.34							
		End of borehole		4.42							
5											
6											
7											
8											
9											
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-9

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L); 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		66.47							Asphaltic coldpatch repair
		Probe Hole - Soil not sampled									
1											
2											Backfilled with auger cuttings
3											
4				61.89							
		End of Probe Hole		4.58							
5											
6											
7											
8											
9											
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

RECORD OF BOREHOLE 24-10

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

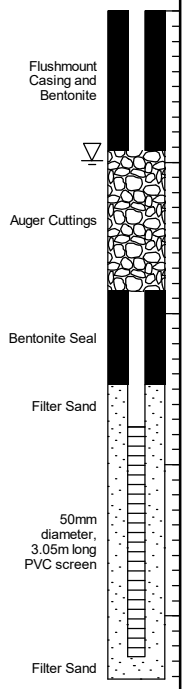
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		65.40					
		100mm ASPHALTIC CONCRETE		0.10					
		Grey crushed sand and gravel, trace silt (BASE MATERIAL)		65.07 0.33	1	SS	250	10	
		Grey crushed sand and gravel, trace silt (SUBBASE MATERIAL)		64.75 0.65					
1		Stiff to very stiff, red grey brown SILTY CLAY, trace sand			2	SS	200	5	
2					3	SS	610	4	MH
		Compact, grey brown silty sand and gravel, some clay, possible cobbles and boulders (GLACIAL TILL)		62.96 2.44	4	SS	350	20	
3		Compact, grey gravelly silty sand, trace clay, possible cobbles and boulders (GLACIAL TILL)		62.35 3.05	5	SS	250	23	MH
4					6	SS	300	20	
		End of Borehole		60.98 4.42					
5									
6									
7									
8									
9									
10									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
24/08/07	1.0 ▽	64.4

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-11

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		65.35					10 20 30 40 50 60 70 80 90		Asphaltic coldpatch repair
		Probe Hole - Soil not sampled									Backfilled with auger cuttings
5				60.16							
		End of Probe Hole		5.19							
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-12

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		64.82				
0	Power Auger Hollow Stem Auger (210mm OD)	60mm ASPHALTIC CONCRETE		0.06				
		Grey, crushed sand and gravel, trace silt (BASE MATERIAL)		64.59 0.23				
		Brown sand and gravel, trace to some silt (SUBBASE MATERIAL)		64.37 0.45	1	SS	375	42
1		Light brown silty sand (FILL MATERIAL)			2	SS	375	12
		FORMER TOPSOIL LAYER		63.60 1.22				
		Stiff to very stiff, red grey brown SILTY CLAY		63.45 1.37	3	SS	450	15
2					4	SS	450	11
		Loose to compact, grey brown silty sand and gravel, some clay, possible cobbles and boulers (GLACIAL TILL)		62.07 2.75				
3		Loose to compact, grey silty sand and gravel, some clay, possible cobbles and boulers (GLACIAL TILL)		61.46 3.36	5	SS	400	19
4					6	SS	150	6
		Loose, grey coarse SAND, some gravel		60.25 4.57	7	SS	400	8
5		End of borehole		59.63 5.19				
6								
7								
8								
9								
10								

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Asphaltic coldpatch repair

Backfilled with auger cuttings

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-14

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 26 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		67.69							Asphaltic coldpatch repair
		Probe Hole - Not Sampled									
1											
2											Backfilled with auger cuttings
3											
4				63.11							
		End of borehole		4.58							
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-15

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 26 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		67.77						
		TOPSOIL		0.03						
		Grey brown silt and sand, some clay, trace gravel and organice material (FILL MATERIAL)			1	SS	400	10		
1					2	SS	350	10	MH	
					3	SS	450	11		
2					4	SS	450	6		Backfilled with auger cuttings
3				64.72						
		Compact, grey SANDY SILT		3.05	5	SS	450	21		
				63.96						
4		Stiff to very stif, grey brown SILTY CLAY		3.81	6	SS	610	2		
				63.35						
		End of borehole		4.42						
5										
6										
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % — W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-16

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 26 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		67.58							
		TOPSOIL		0.05							
		Grey brown silty sand, some clay, trace gravel and organice material (FILL MATERIAL)			1	SS	250	3			
1					2	SS	350	6			
					3	SS	350	4			
2					4	SS	500	8			
3					5	SS	400	3			
4					6	SS	500	3			
					7	SS	500	6			
5				62.39							
		Stiff to very stiff, red grey brown SILTY CLAY		5.19	8	SS	610	6			
6				61.48							
		Stiff to very stiff, grey brown SILTY CLAY		6.10	9	SS	610	2			
				60.87							
		End of borehole		6.71							
7											
8											
9											
10											

10 20 30 40 50 60 70 80 90

Flush mount protective cover
Auger cuttings
Bentonite Seal
Filter sand
50mm diameter, 1.5m long PVC screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
24/08/07	1.1 ▽	66.5

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-17

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		67.69						
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.05						Asphaltic coldpatch repair
		Brown sand, some silt and clay, trace gravel, trace organic material (FILL MATERIAL)			1	SS	350	14	M	
1					2	SS	400	8		
				65.86	3	SS	400	6		
2		Stiff to very stiff, red grey brown SILTY CLAY, trace sand		1.83						Backfilled with auger cuttings
					4	SS	450	7		
3					5	SS	100	2		
4					6	SS	610	4	MH	
				63.27						
		End of borehole		4.42						
5										
6										
7										
8										
9										
10										

SAMPLES: ● PENETRATION RESISTANCE (N), BLOWS/0.3m; ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m

SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED

WATER CONTENT, %: W_P — W — W_L

10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE 24-18

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		61.54							
		TOPSOIL		0.08							
	Power Auger Hollow Stem Auger (210mm OD)	Brown sandy clayey silt, trace gravel, trace boulders (FILL MATERIAL)			1	SS	350	8			Above Ground Protective Casing and Bentonite
1					2	SS	225	51 for 200mm			
2					3	SS	250	53 for 250mm			Auger Cuttings
					4	SS	125	5		MH	
3					5	SS	250	4			
4					6	SS	400	2			
				56.91	7	SS	50	50 for 125mm			
		BEDROCK		4.63							
5					8	RC		TCR= 94%, SCR=75%, RQD= 53%			Bentonite Seal
6					9	RC		TCR= 100%, SCR=71%, RQD= 60%		UC= 97.2 MPa	Filter Sand
7											50mm diameter, 1.5m long PVC screen
8					10	RC		TCR= 98%, SCR=89%, RQD= 85%			
				52.75							
		End of borehole		8.79							
9											
10											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
24/08/07	4.9 ▽	56.7

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

RECORD OF BOREHOLE MW24-1

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station Upgrades
JOB#: 100117.051
LOCATION: See Borehole Location Plan - Figure A1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		62.03							Flush Mount Casing and sand
		Borehole not sampled									
1											Auger Cuttings
2											Bentonite Seal
											Filter Sand
3											50mm diameter, 1.5m long PVC screen
4				58.04 3.99							
5											
6											
7											
8											
9											
10											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
24/08/07	2.4 ▽	59.6

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB

GEO - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 25/1/6

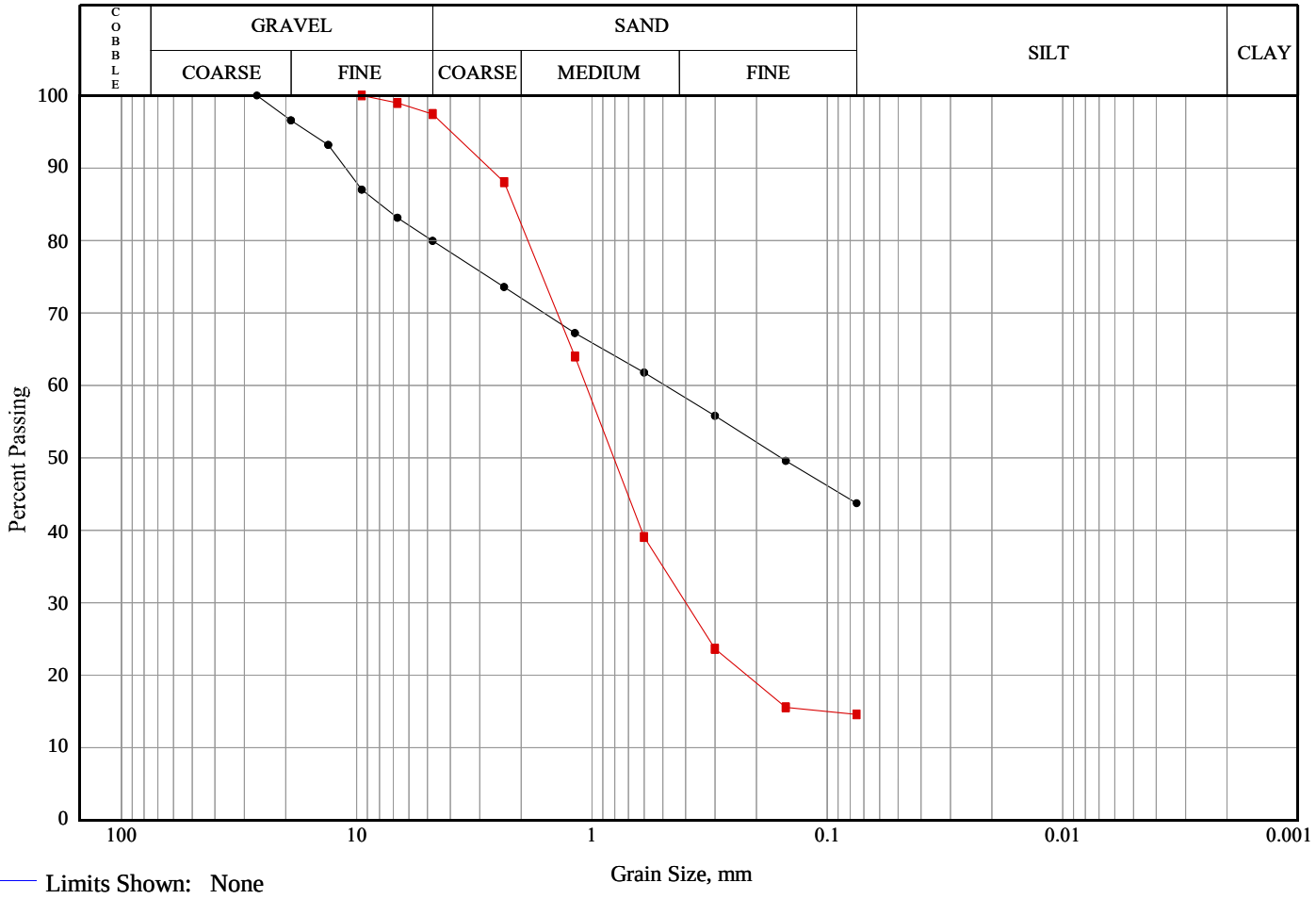
APPENDIX C

Soil Classification Test Results

GEMTEC
Consulting Engineers and Scientists

Client:	J. L. Richards & Associates Limited
Project:	Casselman Main Sewage Pumping Station
Project #:	100117051

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●	Glacial Till	24-06	SS6	3.81-4.41	20.1	36.2	43.7	
■	Fill Material	24-17	SS2	0.76-1.52	2.6	82.9	14.6	

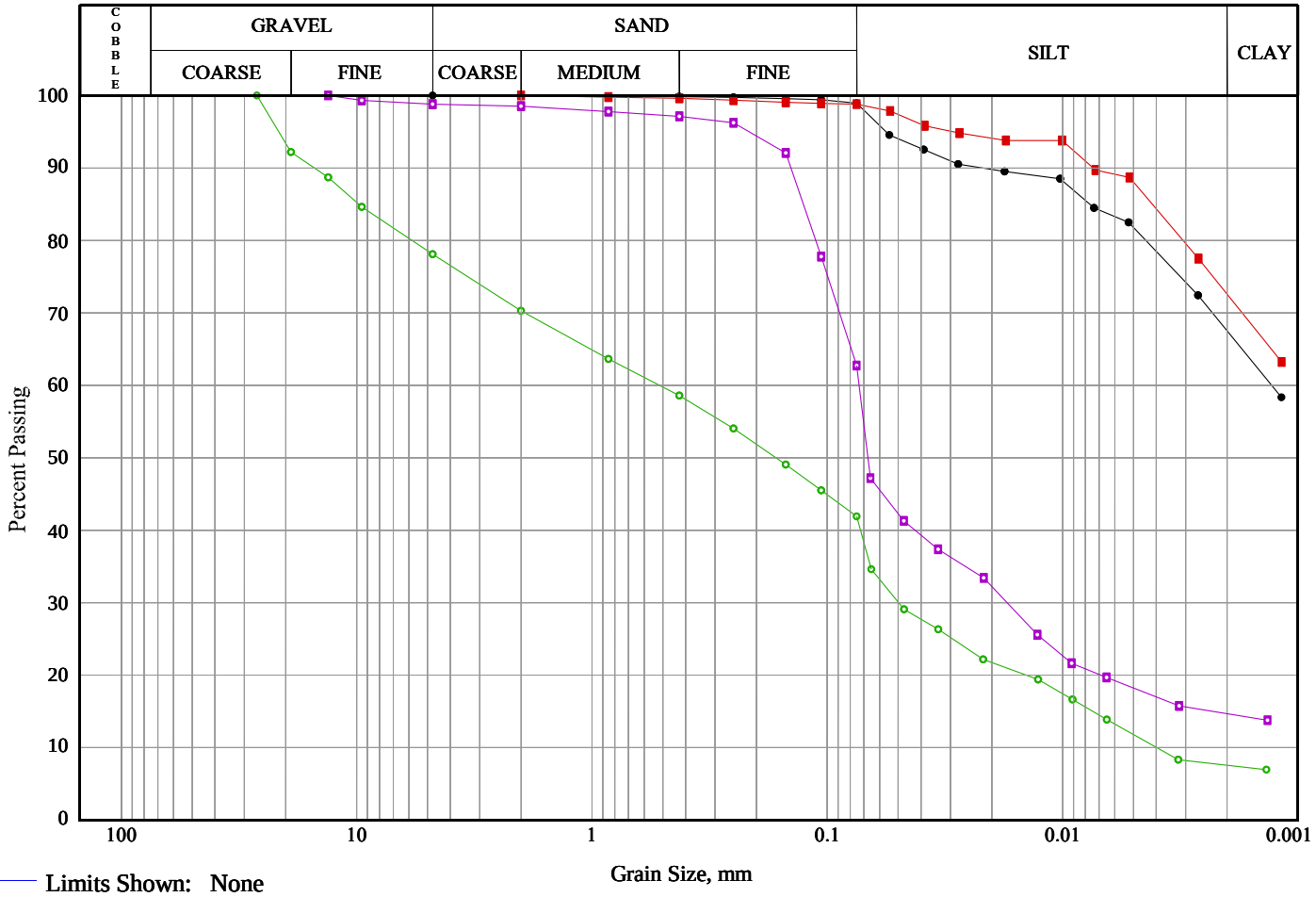
Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Gravelly silt and sand	N/A	---	---	---	0.16	0.49	7.94	---
■	Sand , some silt , trace gravel	N/A	---	0.102	0.40	0.81	1.06	2.16	---

Note: More information available upon request

GEMTEC
Consulting Engineers and Scientists

Client:	J. L. Richards & Associates Limited
Project:	Casselman Main Sewage Pumping Station
Project #:	100117051

Soils Grading Chart (LS-702/ ASTM D-422)



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
		24-01	SS3	1.52-2.13	0.0	1.1	31.4	67.5
		24-10	SS3	1.52-2.13	0.0	1.2	26.2	72.6
	Glacial Till	24-10	SS5	3.04-3.65	21.9	36.2	34.4	7.5
	Fill Material	24-15	SS2	0.76-1.37	1.2	36.1	48.1	14.7

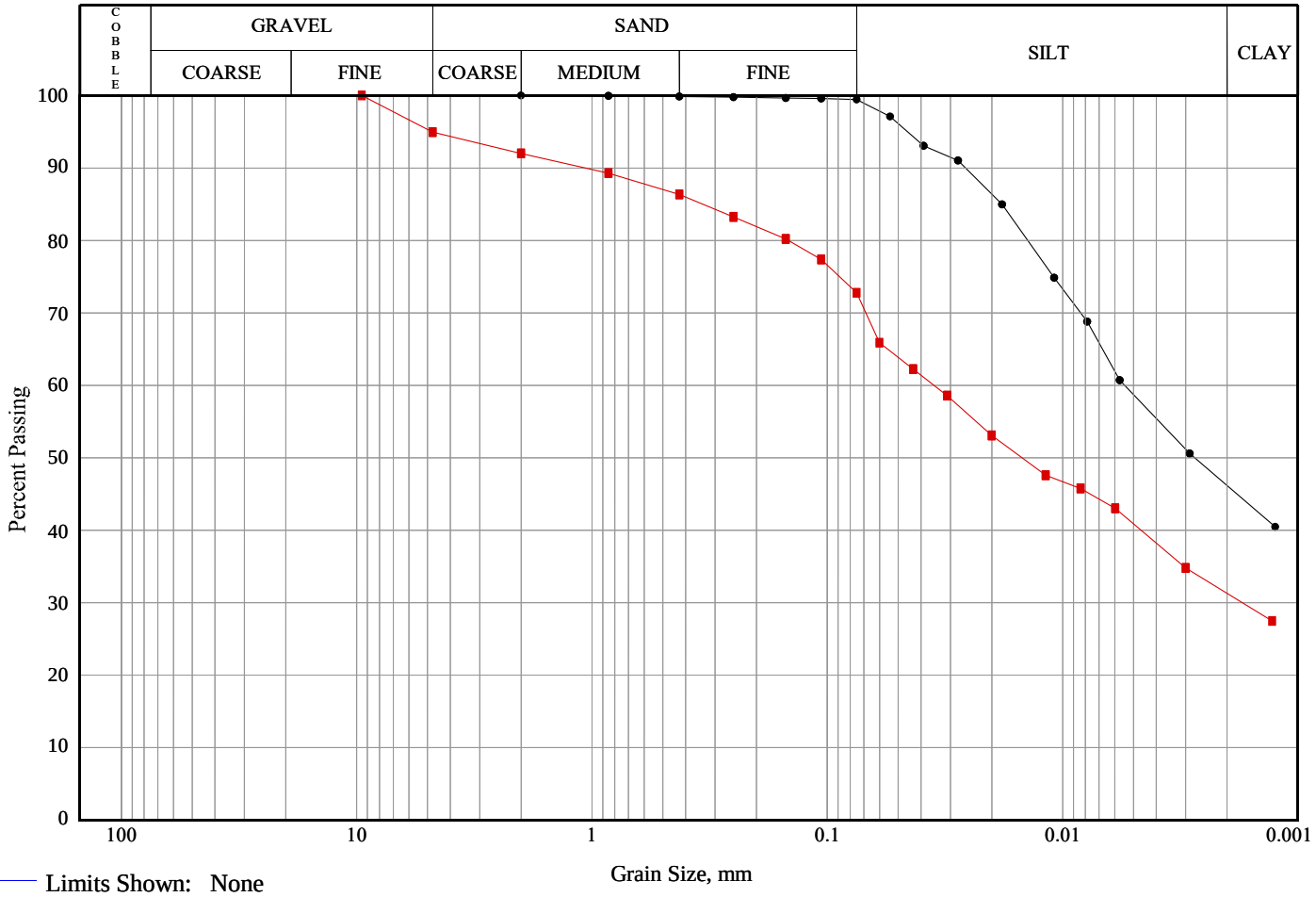
Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Silty clay , trace sand	CH	---	---	---	---	0.00	0.01	31.4
	Silty clay , trace sand	CH	---	---	---	---	---	0.00	26.2
	Gravelly silty sand , trace clay	N/A	0.004	0.007	0.05	0.17	0.52	9.80	34.4
	Silt and sand , some clay , trace gravel	N/A	---	0.002	0.02	0.07	0.07	0.13	48.1

Note: More information available upon request

GEMTEC
Consulting Engineers and Scientists

Client:	J. L. Richards & Associates Limited
Project:	Casselman Main Sewage Pumping Station
Project #:	100117051

Soils Grading Chart (LS-702/ ASTM D-422)



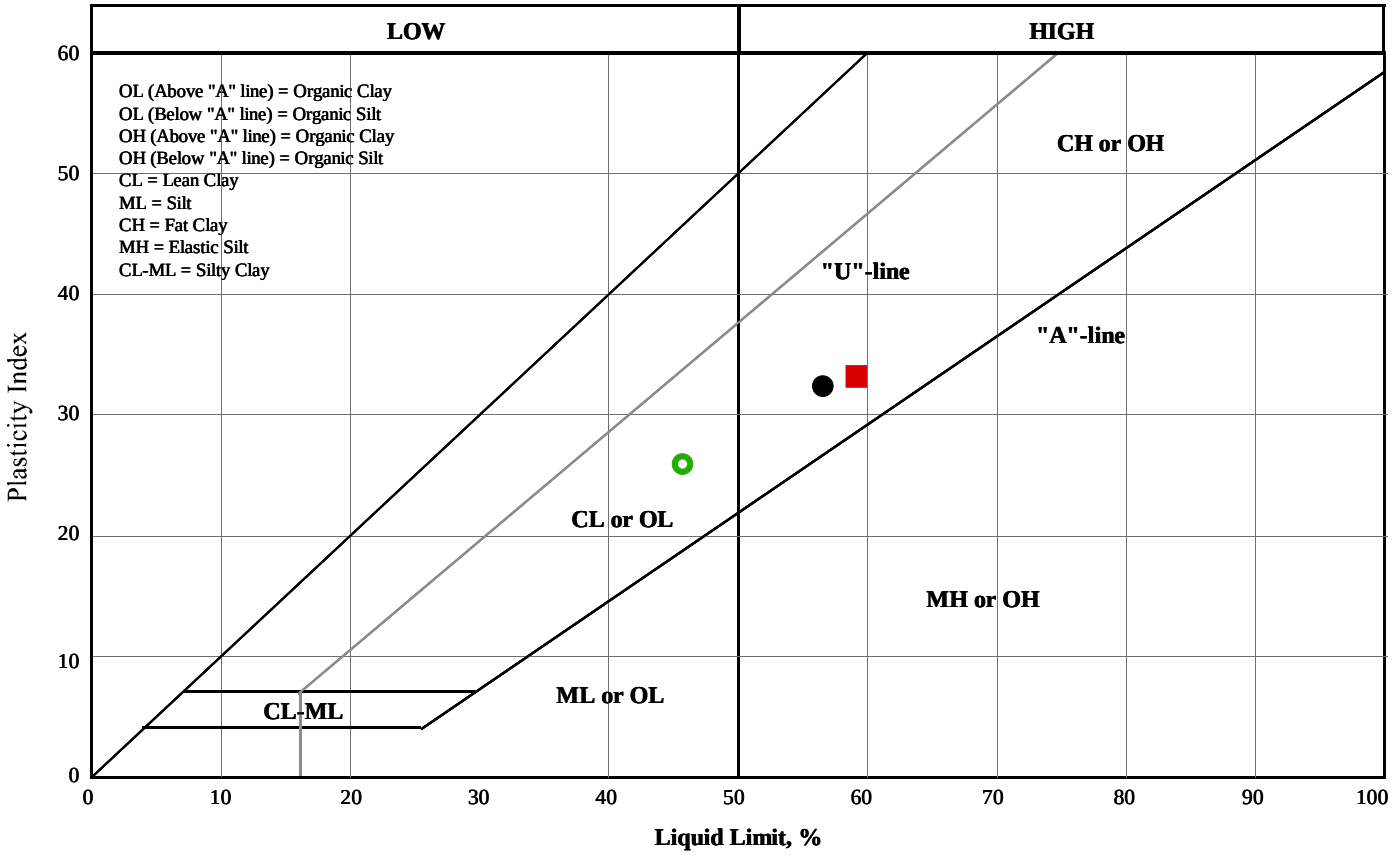
Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●		24-17	SS6	3.81-4.41	0.0	0.6	53.3	46.2
■	Fill Material	24-18	SS4	2.28-2.89	5.1	22.2	41.5	31.3

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Silt and clay , trace sand	CL	---	---	---	0.00	0.01	0.02	53.3
■	Sandy clayey silt , trace gravel	N/A	---	---	0.00	0.01	0.04	0.34	41.5

Note: More information available upon request

GEMTEC Consulting Engineers and Scientists Ottawa, ON	Client: J. L. Richards & Associates Limited	Plasticity Chart (LS-7034/ASTM D4318)
	Project: Casselman Main Sewage Pumping Station	
	Project #: 100117051	



Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	24-01	SS3	1.52-2.13	56.5	24.2	32	N/A	28.3
■	24-10	SS3	1.52-2.13	59.1	26.0	33	N/A	50.5
○	24-17	SS6	3.81-4.41	45.7	19.8	26	N/A	49.8

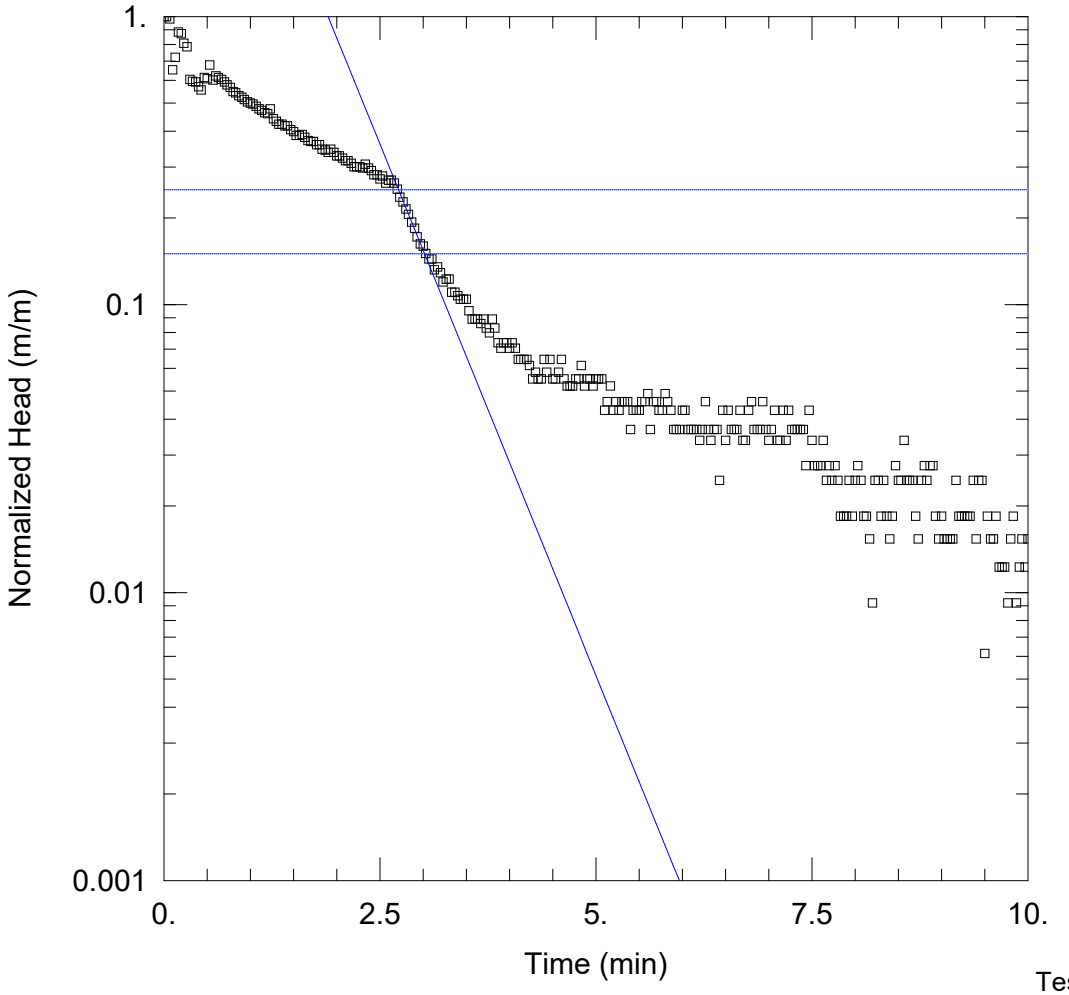
Note: More information available upon request

APPENDIX D

Hydraulic Testing Results

MW24-1: Rising Head Test

Prepared By:	Prepared For:
GEMTEC	JLR
Project:	**Location:**
100117.051	Casselman



Test Date: 2023-09-17

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 2.0E-5 m/sec y0 = 8.19 m

AQUIFER DATA

Saturated Thickness: 2.42 m
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW24-01)

Initial Displacement: 0.33 m
Static Water Column Height: 2.42 m
Total Well Penetration Depth: 2.42 m
Screen Length: 2.42 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m
Gravel Pack Porosity: 0.3

Analysed by: JKA
Reviewed by: AP

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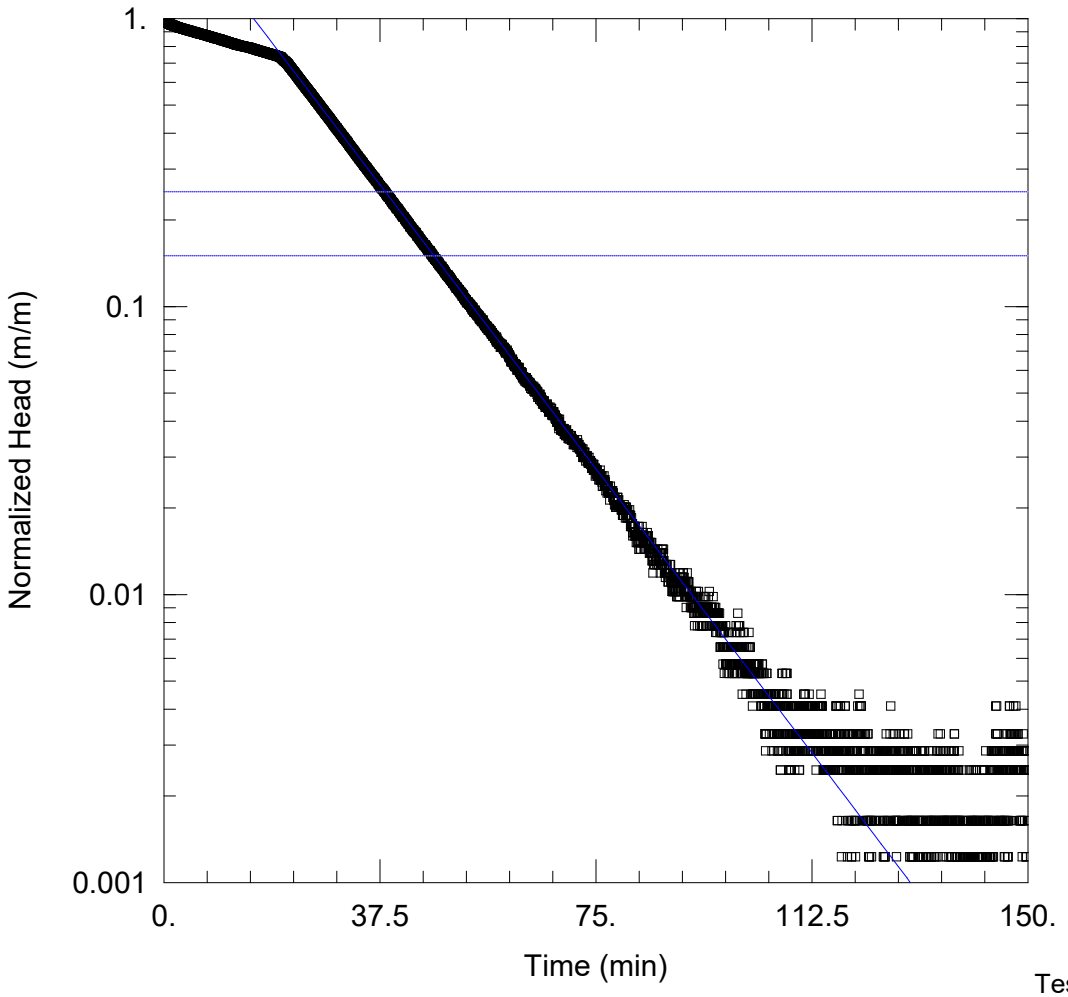
BH24-10: Rising Head Test

Prepared By:	Prepared For:
GEMTEC	JLR
Project:	**Location:**
100117.051	Casselman



Test Date: 2024-09-09

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 1.1E-6 m/sec y0 = 6.26 m

AQUIFER DATA

Saturated Thickness: 2.44 m
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BH24-10)

Initial Displacement: 2.44 m
Static Water Column Height: 2.44 m
Total Well Penetration Depth: 2.44 m
Screen Length: 1.8 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

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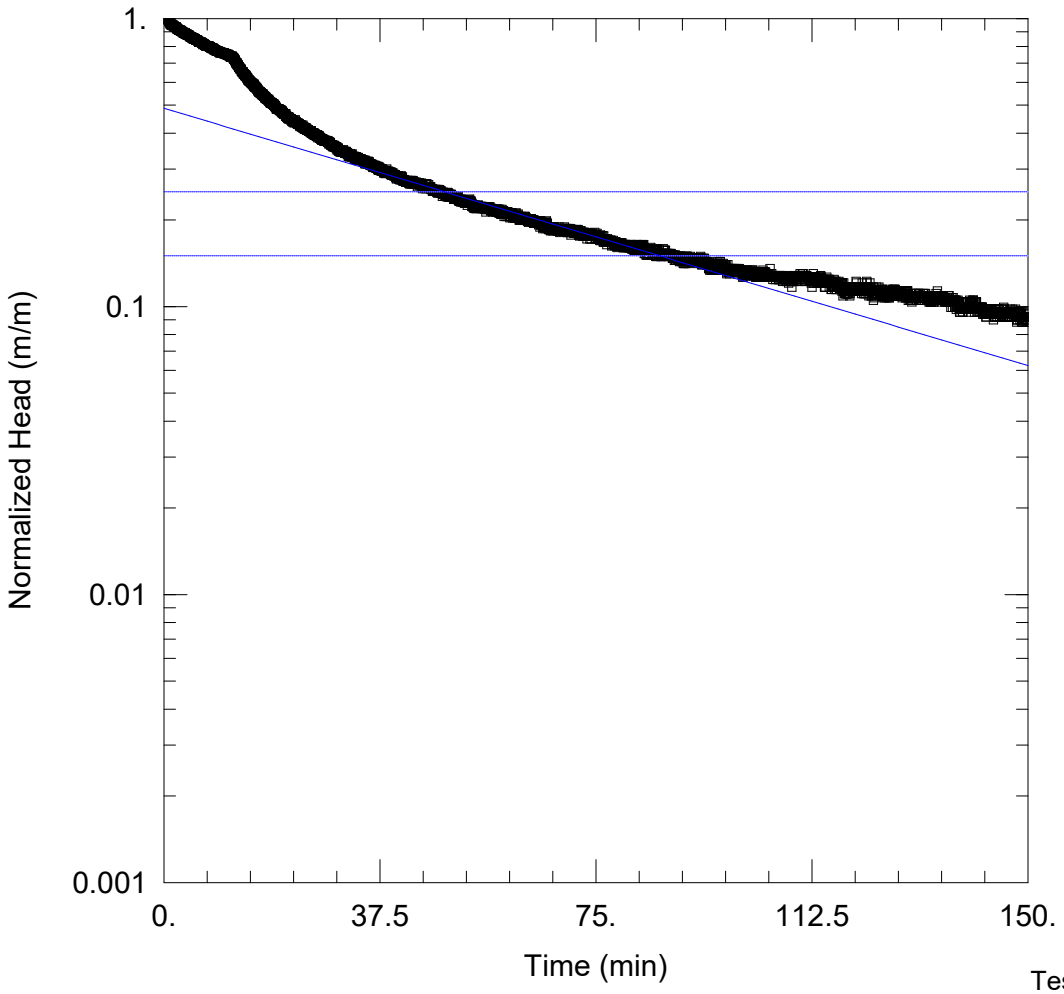
Analysed by: JKA
Reviewed by: AP

BH24-16: Rising Head Test

Prepared By:	Prepared For:
GEMTEC	JLR
Project:	**Location:**
100117.051	Casselman



Test Date: 2023-09-09

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 1.9E-7 m/sec y0 = 0.92 m

AQUIFER DATA

Saturated Thickness: 5.91 m
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BH24-16)

Initial Displacement: 1.89 m
Static Water Column Height: 5.91 m
Total Well Penetration Depth: 5.91 m
Screen Length: 2.44 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

Analysed by: JKA
Reviewed by: AP

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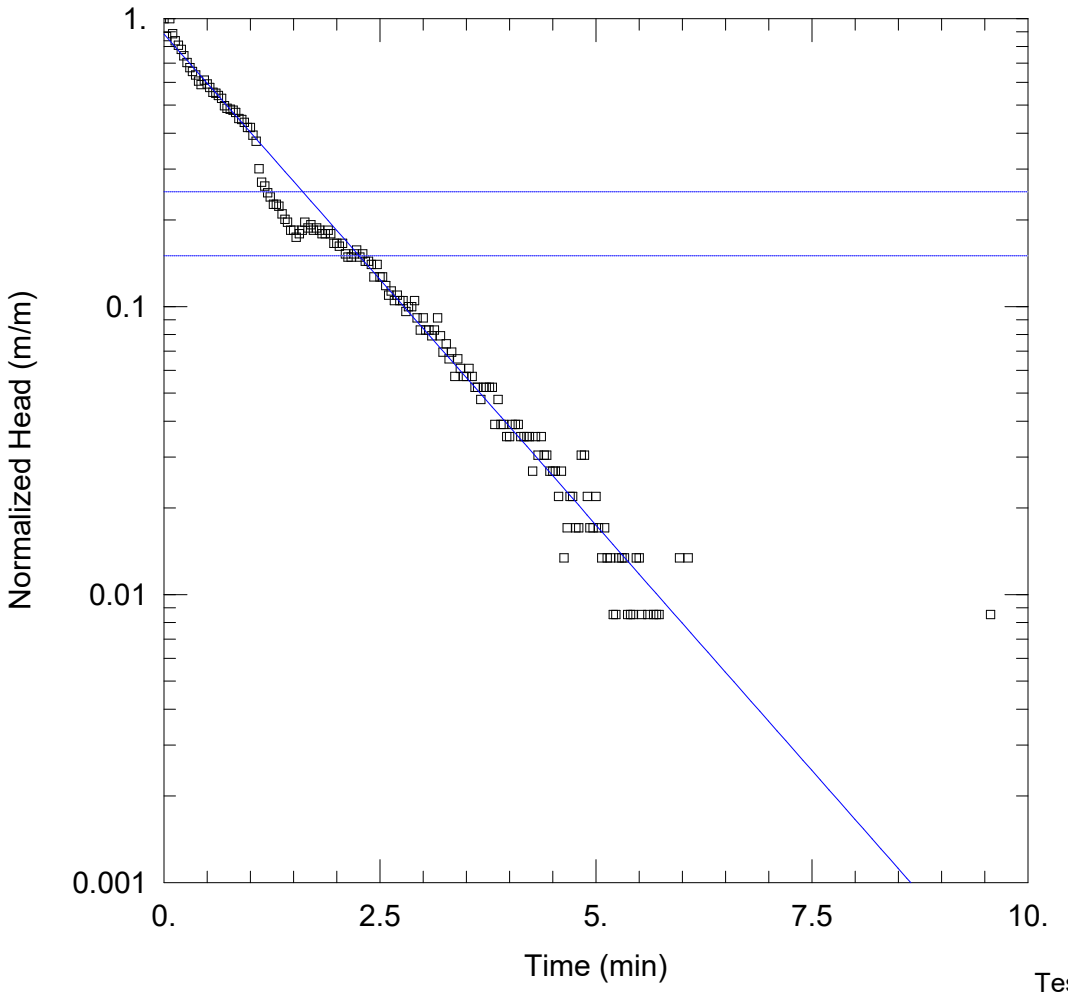
BH24-18: Rising Head Test

Prepared By:	Prepared For:
GEMTEC	JLR
Project:	**Location:**
100117.051	Casselman



Test Date: 2023-08-30

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 1.1E-5 m/sec y0 = 0.72 m

AQUIFER DATA

Saturated Thickness: 4.53 m
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (BH24-18)

Initial Displacement: 0.82 m
Static Water Column Height: 4.53 m
Total Well Penetration Depth: 4.53 m
Screen Length: 2.21 m
Casing Radius: 0.0254 m
Well Radius: 0.0254 m

Analysed by: JKA
Reviewed by: AP

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Consulting Engineers and Scientists

APPENDIX E

Groundwater Quality Results
Chemical Analysis of Groundwater Samples
Relating to Corrosion
(Paracel Laboratories Ltd. Order No. 2432488, 2437224)

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Andrius Paznekas

Client PO:
Project: 100117.051
Custody: 137760

Report Date: 19-Aug-2024
Order Date: 9-Aug-2024

Order #: 2432488

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2432488-01	MW24-10
2432488-02	MW24-16
2432488-03	MW24-18

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	12-Aug-24	12-Aug-24
Hexachlorobenzene	EPA 8081B - GC-ECD	14-Aug-24	14-Aug-24
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	12-Aug-24	12-Aug-24
Metals, ICP-MS	EPA 200.8 - ICP-MS	12-Aug-24	12-Aug-24
Ottawa - San/Comb: SVOCs with PAHs	EPA 625 - GC-MS, extraction	15-Aug-24	16-Aug-24
PCBs, total	EPA 608 - GC-ECD	14-Aug-24	14-Aug-24
pH	EPA 150.1 - pH probe @25 °C	12-Aug-24	12-Aug-24
PHC F1	CWS Tier 1 - P&T GC-FID	13-Aug-24	13-Aug-24
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	14-Aug-24	14-Aug-24
Phosphorus, total, water	EPA 365.4 - Auto Colour, digestion	12-Aug-24	12-Aug-24
Resistivity	EPA 120.1 - probe	12-Aug-24	12-Aug-24
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	12-Aug-24	12-Aug-24
Total Suspended Solids	SM 2540D - Gravimetric	10-Aug-24	12-Aug-24
VOCs by P&T GC-MS	EPA 624 - P&T GC-MS	13-Aug-24	13-Aug-24
Volatile Suspended Solids	SM 2540D - Gravimetric, 550C	10-Aug-24	12-Aug-24

Certificate of Analysis

Report Date: 19-Aug-2024

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 9-Aug-2024

Client PO:

Project Description: 100117.051

	Client ID:	MW24-10	MW24-16	MW24-18	-	-	-
	Sample Date:	08-Aug-24 15:00	08-Aug-24 16:00	08-Aug-24 14:00	-		
	Sample ID:	2432488-01	2432488-02	2432488-03	-		
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
General Inorganics							
pH	0.1 pH Units	8.2	6.6	7.6	-	-	-
Phosphorus, total	0.01 mg/L	0.80	4.48	3.02	-	-	-
Resistivity	0.01 Ohm.m	6.61	7.50	3.85	-	-	-
Total Suspended Solids	2 mg/L	308	2630	7180	-	-	-
Volatile Suspended Solids	2 mg/L	21	70	470	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.3	7.1	4.0	-	-	-
Anions							
Chloride	1 mg/L	224	21	493	-	-	-
Sulphate	1 mg/L	87	1	93	-	-	-
Metals - Total							
Aluminum	0.01 mg/L	0.92	23.3	53.5	-	-	-
Antimony	0.001 mg/L	<0.001	0.001	0.001	-	-	-
Arsenic	0.01 mg/L	<0.01	<0.01	0.02	-	-	-
Bismuth	0.005 mg/L	<0.005	<0.005	<0.005	-	-	-
Boron	0.05 mg/L	<0.05	<0.05	0.07	-	-	-
Cadmium	0.001 mg/L	<0.001	<0.001	<0.001	-	-	-
Chromium	0.05 mg/L	<0.05	0.06	0.17	-	-	-
Cobalt	0.001 mg/L	<0.001	0.027	0.034	-	-	-
Copper	0.005 mg/L	<0.005	0.028	0.095	-	-	-
Lead	0.001 mg/L	<0.001	0.007	0.065	-	-	-
Manganese	0.05 mg/L	0.08	37.8	2.75	-	-	-
Mercury	0.0001 mg/L	<0.0001	0.0001	<0.0001	-	-	-
Molybdenum	0.005 mg/L	<0.005	<0.005	0.012	-	-	-
Nickel	0.005 mg/L	<0.005	0.033	0.092	-	-	-
Selenium	0.005 mg/L	<0.005	0.008	0.010	-	-	-

	Client ID:	MW24-10	MW24-16	MW24-18	-	-	-
	Sample Date:	08-Aug-24 15:00	08-Aug-24 16:00	08-Aug-24 14:00	-		
	Sample ID:	2432488-01	2432488-02	2432488-03	-		
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
Metals - Total							
Silver	0.001 mg/L	<0.001	<0.001	0.011	-	-	-
Tin	0.01 mg/L	<0.01	<0.01	<0.01	-	-	-
Titanium	0.01 mg/L	0.05	1.25	2.64	-	-	-
Vanadium	0.001 mg/L	0.003	0.059	0.119	-	-	-
Zinc	0.02 mg/L	<0.02	0.04	0.23	-	-	-
Volatiles							
Acetone	0.0050 mg/L	<0.0050	<0.0050	<0.0050	-	-	-
Benzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Bromodichloromethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Bromoform	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Bromomethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Carbon Tetrachloride	0.0002 mg/L	<0.0002	<0.0002	<0.0002	-	-	-
Chlorobenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Chloroethane	0.0010 mg/L	<0.0010	<0.0010	<0.0010	-	-	-
Chloroform	0.0005 mg/L	<0.0005	<0.0005	0.0022	-	-	-
Chloromethane	0.0030 mg/L	<0.0030	<0.0030	<0.0030	-	-	-
Dibromochloromethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Dichlorodifluoromethane	0.0010 mg/L	<0.0010	<0.0010	<0.0010	-	-	-
1,2-Dibromoethane	0.0002 mg/L	<0.0002	<0.0002	<0.0002	-	-	-
1,2-Dichlorobenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,3-Dichlorobenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,4-Dichlorobenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,1-Dichloroethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,2-Dichloroethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,1-Dichloroethylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-

	Client ID:	MW24-10	MW24-16	MW24-18	-	-	-
	Sample Date:	08-Aug-24 15:00	08-Aug-24 16:00	08-Aug-24 14:00	-		
	Sample ID:	2432488-01	2432488-02	2432488-03	-		
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
Volatiles							
cis-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
trans-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,2-Dichloroethylene, total	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,2-Dichloropropane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
cis-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
trans-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,3-Dichloropropene, total	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Ethylbenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Hexane	0.0010 mg/L	<0.0010	<0.0010	<0.0010	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.0050 mg/L	<0.0050	<0.0050	<0.0050	-	-	-
Methyl Butyl Ketone (2-Hexanone)	0.0100 mg/L	<0.0100	<0.0100	<0.0100	-	-	-
Methyl Isobutyl Ketone	0.0050 mg/L	<0.0050	<0.0050	<0.0050	-	-	-
Methyl tert-butyl ether	0.0020 mg/L	<0.0020	<0.0020	<0.0020	-	-	-
Methylene Chloride	0.0050 mg/L	<0.0050	<0.0050	<0.0050	-	-	-
Styrene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,1,1,2-Tetrachloroethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,1,2,2-Tetrachloroethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Tetrachloroethylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Toluene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,1,1-Trichloroethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
1,1,2-Trichloroethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Trichloroethylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Trichlorofluoromethane	0.0010 mg/L	<0.0010	<0.0010	<0.0010	-	-	-
1,3,5-Trimethylbenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Vinyl chloride	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-

	Client ID:	MW24-10	MW24-16	MW24-18	-	-	-
	Sample Date:	08-Aug-24 15:00	08-Aug-24 16:00	08-Aug-24 14:00	-		
	Sample ID:	2432488-01	2432488-02	2432488-03	-		
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
Volatiles							
m,p-Xylenes	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
o-Xylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Xylenes, total	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	-	-
Toluene-d8	Surrogate	105%	105%	106%	-	-	-
Dibromofluoromethane	Surrogate	105%	107%	105%	-	-	-
4-Bromofluorobenzene	Surrogate	116%	117%	117%	-	-	-
Hydrocarbons							
F1 PHCs (C6-C10)	0.025 mg/L	<0.025	<0.025	<0.025	-	-	-
F2 PHCs (C10-C16)	0.1 mg/L	<0.1	<0.1	<0.1	-	-	-
F3 PHCs (C16-C34)	0.1 mg/L	<0.1	<0.1	<0.1	-	-	-
F4 PHCs (C34-C50)	0.1 mg/L	<0.1	<0.1	<0.1	-	-	-
Semi-Volatiles							
1-Methylnaphthalene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
2-Methylnaphthalene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
7H-Dibenzo[c,g]carbazole	0.00050 mg/L	<0.00050	<0.00050	<0.00050	-	-	-
Anthracene	0.00001 mg/L	<0.00001	<0.00001	<0.00001	-	-	-
Benzo [a] anthracene	0.00001 mg/L	<0.00001	<0.00001	0.00010	-	-	-
Benzo [a] pyrene	0.00001 mg/L	<0.00001	<0.00001	0.00013	-	-	-
Benzo [b&j] fluoranthene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
Benzo [e] pyrene	0.00005 mg/L	<0.00005	<0.00005	0.00009	-	-	-
Benzo [g,h,i] perylene	0.00005 mg/L	<0.00005	<0.00005	0.00010	-	-	-
Benzo [k] fluoranthene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
Benzylbutylphthalate	0.00050 mg/L	<0.00050	<0.00050	<0.00050	-	-	-
Biphenyl	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
Bis(2-chloroethoxy)methane	0.00100 mg/L	<0.00100	<0.00100	<0.00100	-	-	-

	Client ID:	MW24-10	MW24-16	MW24-18	-	-	-
	Sample Date:	08-Aug-24 15:00	08-Aug-24 16:00	08-Aug-24 14:00	-		
	Sample ID:	2432488-01	2432488-02	2432488-03	-		
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
Semi-Volatiles							
Bis(2-ethylhexyl)phthalate	0.00100 mg/L	0.00332	<0.00100	<0.00100	-	-	-
Chrysene	0.00005 mg/L	<0.00005	<0.00005	0.00013	-	-	-
Dibenzo [a,h] anthracene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
Dibenzo [a,i] pyrene	0.00050 mg/L	<0.00050	<0.00050	<0.00050	-	-	-
Dibenzo [a,j] acridine	0.00050 mg/L	<0.00050	<0.00050	<0.00050	-	-	-
Diethylphthalate	0.00100 mg/L	<0.00100	<0.00100	<0.00100	-	-	-
Di-n-butylphthalate	0.00100 mg/L	<0.00100	<0.00100	0.00121	-	-	-
Di-n-octylphthalate	0.00100 mg/L	<0.00100	<0.00100	<0.00100	-	-	-
Fluoranthene	0.00001 mg/L	<0.00001	0.00004	0.00021	-	-	-
Fluorene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
Indeno [1,2,3-cd] pyrene	0.00005 mg/L	<0.00005	<0.00005	0.00011	-	-	-
Indole	0.00100 mg/L	<0.00100	<0.00100	<0.00100	-	-	-
Naphthalene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
Phenanthrene	0.00005 mg/L	<0.00005	<0.00005	<0.00005	-	-	-
Perylene	0.00050 mg/L	<0.00050	<0.00050	<0.00050	-	-	-
Pyrene	0.00001 mg/L	0.000085	0.00006	0.00016	-	-	-
2,4-Dichlorophenol	0.00100 mg/L	<0.00100	<0.00100	<0.00100	-	-	-
PAHs, Total	0.0025 mg/L	<0.0025	<0.0025	<0.0025	-	-	-
2-Fluorobiphenyl	Surrogate	67.9%	65.5%	75.3%	-	-	-
Nitrobenzene-d5	Surrogate	55.1%	56.4%	64.2%	-	-	-
Terphenyl-d14	Surrogate	82.7%	76.9%	71.6%	-	-	-
2,4,6-Tribromophenol	Surrogate	77.3%	90.8%	85.4%	-	-	-
2-Fluorophenol	Surrogate	2.85% [2]	3.26% [2]	4.98% [2]	-	-	-
Phenol-d6	Surrogate	3.36% [2]	3.69% [2]	5.17% [2]	-	-	-
Pesticides, OC							

	Client ID:	MW24-10	MW24-16	MW24-18	-		
	Sample Date:	08-Aug-24 15:00	08-Aug-24 16:00	08-Aug-24 14:00	-	-	-
	Sample ID:	2432488-01	2432488-02	2432488-03	-		
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
Pesticides, OC							
Hexachlorobenzene	0.00001 mg/L	<0.00001	<0.00001	<0.00001	-	-	-
Decachlorobiphenyl	Surrogate	86.0%	62.0%	90.0%	-	-	-
PCBs							
PCBs, total	0.05 ug/L	<0.05	<0.05	<0.05	-	-	-
Decachlorobiphenyl	Surrogate	98.8%	64.3%	100%	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	1	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
Phosphorus, total	ND	0.01	mg/L					
Resistivity	ND	0.01	Ohm.m					
Total Suspended Solids	ND	2	mg/L					
Volatile Suspended Solids	ND	2	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Hydrocarbons								
F1 PHCs (C6-C10)	ND	0.025	mg/L					
F2 PHCs (C10-C16)	ND	0.1	mg/L					
F3 PHCs (C16-C34)	ND	0.1	mg/L					
F4 PHCs (C34-C50)	ND	0.1	mg/L					
Metals - Total								
Aluminum	ND	0.01	mg/L					
Antimony	ND	0.001	mg/L					
Arsenic	ND	0.01	mg/L					
Bismuth	ND	0.005	mg/L					
Boron	ND	0.05	mg/L					
Cadmium	ND	0.001	mg/L					
Chromium	ND	0.05	mg/L					
Cobalt	ND	0.001	mg/L					
Copper	ND	0.005	mg/L					
Lead	ND	0.001	mg/L					
Mercury	ND	0.0001	mg/L					
Manganese	ND	0.05	mg/L					
Molybdenum	ND	0.005	mg/L					
Nickel	ND	0.005	mg/L					
Selenium	ND	0.005	mg/L					
Silver	ND	0.001	mg/L					
Tin	ND	0.01	mg/L					
Titanium	ND	0.01	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Vanadium	ND	0.001	mg/L					
Zinc	ND	0.02	mg/L					
PCBs								
PCBs, total	ND	0.05	ug/L					
Surrogate: Decachlorobiphenyl	*0.472*		*%*	*94.4*	*60-140*			
Pesticides, OC								
Hexachlorobenzene	ND	0.00001	mg/L					
Surrogate: Decachlorobiphenyl	*.00035*		*%*	*70.0*	*50-140*			
Semi-Volatiles								
1-Methylnaphthalene	ND	0.00005	mg/L					
2-Methylnaphthalene	ND	0.00005	mg/L					
7H-Dibenzo[c,g]carbazole	ND	0.00050	mg/L					
Anthracene	ND	0.00001	mg/L					
Benzo [a] anthracene	ND	0.00001	mg/L					
Benzo [a] pyrene	ND	0.00001	mg/L					
Benzo [b&j] fluoranthene	ND	0.00005	mg/L					
Benzo [e] pyrene	ND	0.00005	mg/L					
Benzo [g,h,i] perylene	ND	0.00005	mg/L					
Benzo [k] fluoranthene	ND	0.00005	mg/L					
Benzylbutylphthalate	ND	0.00050	mg/L					
Biphenyl	ND	0.00005	mg/L					
Bis(2-chloroethoxy)methane	ND	0.00100	mg/L					
Bis(2-ethylhexyl)phthalate	ND	0.00100	mg/L					
Chrysene	ND	0.00005	mg/L					
Dibenzo [a,h] anthracene	ND	0.00005	mg/L					
Dibenzo [a,i] pyrene	ND	0.00050	mg/L					
Dibenzo [a,j] acridine	ND	0.00050	mg/L					
Diethylphthalate	ND	0.00100	mg/L					
Di-n-butylphthalate	ND	0.00100	mg/L					
Di-n-octylphthalate	ND	0.00100	mg/L					
Fluoranthene	ND	0.00001	mg/L					
Fluorene	ND	0.00005	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Indeno [1,2,3-cd] pyrene	ND	0.00005	mg/L					
Indole	ND	0.00100	mg/L					
Naphthalene	ND	0.00005	mg/L					
Phenanthrene	ND	0.00005	mg/L					
Perylene	ND	0.00050	mg/L					
Pyrene	ND	0.00001	mg/L					
2,4-Dichlorophenol	ND	0.00100	mg/L					
Surrogate: 2-Fluorobiphenyl	*0.0166*		*%*	*83.0*	*50-140*			
Surrogate: Nitrobenzene-d5	*0.0134*		*%*	*67.2*	*50-140*			
Surrogate: Terphenyl-d14	*0.0168*		*%*	*83.9*	*50-140*			
Surrogate: 2,4,6-Tribromophenol	*0.0388*		*%*	*97.1*	*50-140*			
Surrogate: 2-Fluorophenol	*0.00295*		*%*	*7.39*	*50-140*			S-GC
Surrogate: Phenol-d6	*0.00328*		*%*	*8.20*	*50-140*			S-GC
Volatiles								
Acetone	ND	0.0050	mg/L					
Benzene	ND	0.0005	mg/L					
Bromodichloromethane	ND	0.0005	mg/L					
Bromoform	ND	0.0005	mg/L					
Bromomethane	ND	0.0005	mg/L					
Carbon Tetrachloride	ND	0.0002	mg/L					
Chlorobenzene	ND	0.0005	mg/L					
Chloroethane	ND	0.0010	mg/L					
Chloroform	ND	0.0005	mg/L					
Chloromethane	ND	0.0030	mg/L					
Dibromochloromethane	ND	0.0005	mg/L					
Dichlorodifluoromethane	ND	0.0010	mg/L					
1,2-Dibromoethane	ND	0.0002	mg/L					
1,2-Dichlorobenzene	ND	0.0005	mg/L					
1,3-Dichlorobenzene	ND	0.0005	mg/L					
1,4-Dichlorobenzene	ND	0.0005	mg/L					
1,1-Dichloroethane	ND	0.0005	mg/L					
1,2-Dichloroethane	ND	0.0005	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
1,1-Dichloroethylene	ND	0.0005	mg/L					
cis-1,2-Dichloroethylene	ND	0.0005	mg/L					
trans-1,2-Dichloroethylene	ND	0.0005	mg/L					
1,2-Dichloroethylene, total	ND	0.0005	mg/L					
1,2-Dichloropropane	ND	0.0005	mg/L					
cis-1,3-Dichloropropylene	ND	0.0005	mg/L					
trans-1,3-Dichloropropylene	ND	0.0005	mg/L					
1,3-Dichloropropene, total	ND	0.0005	mg/L					
Ethylbenzene	ND	0.0005	mg/L					
Hexane	ND	0.0010	mg/L					
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L					
Methyl Butyl Ketone (2-Hexanone)	ND	0.0100	mg/L					
Methyl Isobutyl Ketone	ND	0.0050	mg/L					
Methyl tert-butyl ether	ND	0.0020	mg/L					
Methylene Chloride	ND	0.0050	mg/L					
Styrene	ND	0.0005	mg/L					
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L					
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L					
Tetrachloroethylene	ND	0.0005	mg/L					
Toluene	ND	0.0005	mg/L					
1,1,1-Trichloroethane	ND	0.0005	mg/L					
1,1,2-Trichloroethane	ND	0.0005	mg/L					
Trichloroethylene	ND	0.0005	mg/L					
Trichlorofluoromethane	ND	0.0010	mg/L					
1,3,5-Trimethylbenzene	ND	0.0005	mg/L					
Vinyl chloride	ND	0.0005	mg/L					
m,p-Xylenes	ND	0.0005	mg/L					
o-Xylene	ND	0.0005	mg/L					
Xylenes, total	ND	0.0005	mg/L					
Surrogate: 4-Bromofluorobenzene	*0.0909*		*%*	*114*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0789*		*%*	*98.6*	*50-140*			
Surrogate: Toluene-d8	*0.0799*		*%*	*99.8*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	17.2	1	mg/L	17.0			0.6	20	
Sulphate	50.5	1	mg/L	50.7			0.4	10	
General Inorganics									
pH	8.2	0.1	pH Units	8.2			0.0	3.3	
Phosphorus, total	0.037	0.01	mg/L	0.041			10.3	15	
Total Suspended Solids	303	2	mg/L	308			1.6	10	
Volatile Suspended Solids	22.0	2	mg/L	21.0			4.7	10	
Total Kjeldahl Nitrogen	6.02	0.2	mg/L	5.74			4.7	16	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L	ND			NC	30	
Metals - Total									
Aluminum	2.94	0.01	mg/L	2.85			3.2	20	
Antimony	0.005	0.001	mg/L	0.005			1.4	20	
Arsenic	ND	0.01	mg/L	ND			NC	20	
Bismuth	ND	0.005	mg/L	ND			NC	20	
Boron	0.42	0.05	mg/L	0.41			3.3	20	
Cadmium	ND	0.001	mg/L	ND			NC	20	
Chromium	ND	0.05	mg/L	ND			NC	20	
Cobalt	ND	0.001	mg/L	ND			NC	20	
Copper	0.015	0.005	mg/L	0.015			0.2	20	
Lead	ND	0.001	mg/L	ND			NC	20	
Mercury	ND	0.0001	mg/L	ND			NC	20	
Manganese	ND	0.05	mg/L	ND			NC	20	
Molybdenum	0.028	0.005	mg/L	0.028			0.9	20	
Nickel	0.014	0.005	mg/L	0.014			1.6	20	
Selenium	ND	0.005	mg/L	ND			NC	20	
Silver	ND	0.001	mg/L	ND			NC	20	
Tin	ND	0.01	mg/L	ND			NC	20	
Titanium	ND	0.01	mg/L	ND			NC	20	
Vanadium	0.003	0.001	mg/L	0.003			1.7	20	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Zinc	ND	0.02	mg/L	ND			NC	20	
Volatiles									
Acetone	ND	0.0050	mg/L	ND			NC	30	
Benzene	ND	0.0005	mg/L	ND			NC	30	
Bromodichloromethane	ND	0.0005	mg/L	ND			NC	30	
Bromoform	ND	0.0005	mg/L	ND			NC	30	
Bromomethane	ND	0.0005	mg/L	ND			NC	30	
Carbon Tetrachloride	ND	0.0002	mg/L	ND			NC	30	
Chlorobenzene	ND	0.0005	mg/L	ND			NC	30	
Chloroethane	ND	0.0010	mg/L	ND			NC	30	
Chloroform	0.00222	0.0005	mg/L	0.00220			0.9	30	
Chloromethane	ND	0.0030	mg/L	ND			NC	30	
Dibromochloromethane	ND	0.0005	mg/L	ND			NC	30	
Dichlorodifluoromethane	ND	0.0010	mg/L	ND			NC	30	
1,2-Dibromoethane	ND	0.0002	mg/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloropropane	ND	0.0005	mg/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
Ethylbenzene	ND	0.0005	mg/L	ND			NC	30	
Hexane	ND	0.0010	mg/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L	ND			NC	30	
Methyl Butyl Ketone (2-Hexanone)	ND	0.0100	mg/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	0.0050	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Methyl tert-butyl ether	ND	0.0020	mg/L	ND			NC	30	
Methylene Chloride	ND	0.0050	mg/L	ND			NC	30	
Styrene	ND	0.0005	mg/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
Tetrachloroethylene	ND	0.0005	mg/L	ND			NC	30	
Toluene	ND	0.0005	mg/L	ND			NC	30	
1,1,1-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
Trichloroethylene	ND	0.0005	mg/L	ND			NC	30	
Trichlorofluoromethane	ND	0.0010	mg/L	ND			NC	30	
1,3,5-Trimethylbenzene	ND	0.0005	mg/L	ND			NC	30	
Vinyl chloride	ND	0.0005	mg/L	ND			NC	30	
m,p-Xylenes	ND	0.0005	mg/L	ND			NC	30	
o-Xylene	ND	0.0005	mg/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*0.0923*		*%*		*115*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0840*		*%*		*105*	*50-140*			
Surrogate: Toluene-d8	*0.0846*		*%*		*106*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	26.2	1	mg/L	17.0	91.7	70-124			
Sulphate	59.6	1	mg/L	50.7	88.3	74-126			
General Inorganics									
Phosphorus, total	0.912	0.01	mg/L	0.041	87.1	80-120			
Total Suspended Solids	23.0	2	mg/L	ND	107	75-125			
Total Kjeldahl Nitrogen	0.96	0.1	mg/L	ND	96.3	81-126			
Hydrocarbons									
F1 PHCs (C6-C10)	1.86	0.025	mg/L	ND	108	85-115			
F2 PHCs (C10-C16)	1.6	0.1	mg/L	ND	103	60-140			
F3 PHCs (C16-C34)	4.1	0.1	mg/L	ND	105	60-140			
F4 PHCs (C34-C50)	2.3	0.1	mg/L	ND	93.7	60-140			
Metals - Total									
Aluminum	349	0.01	mg/L	285	128	80-120			QM-07
Arsenic	50.2	0.01	mg/L	0.132	100	80-120			
Bismuth	44.8	0.005	mg/L	0.006	89.6	80-120			
Boron	91.0	0.05	mg/L	40.8	100	80-120			
Cadmium	44.9	0.001	mg/L	0.003	89.8	80-120			
Chromium	55.9	0.05	mg/L	0.396	111	80-120			
Cobalt	52.8	0.001	mg/L	0.096	105	80-120			
Copper	50.7	0.005	mg/L	1.47	98.5	80-120			
Lead	46.9	0.001	mg/L	0.084	93.7	80-120			
Mercury	0.0028	0.0001	mg/L	ND	93.2	70-130			
Manganese	54.9	0.05	mg/L	1.31	107	80-120			
Molybdenum	53.8	0.005	mg/L	2.80	102	80-120			
Nickel	52.6	0.005	mg/L	1.38	102	80-120			
Selenium	46.2	0.005	mg/L	0.259	91.9	80-120			
Silver	37.2	0.001	mg/L	0.003	74.4	80-120			QM-07
Tin	47.0	0.01	mg/L	0.447	93.1	80-120			
Titanium	57.7	0.01	mg/L	0.056	115	80-120			
Vanadium	56.3	0.001	mg/L	0.272	112	80-120			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Zinc	48.0	0.02	mg/L	0.555	94.9	80-120			
PCBs									
PCBs, total	1.17	0.05	ug/L	ND	117	65-135			
Surrogate: Decachlorobiphenyl	*0.502*		*%*		*100*	*60-140*			
Pesticides, OC									
Hexachlorobenzene	0.00060	0.00001	mg/L	ND	121	50-140			
Surrogate: Decachlorobiphenyl	*0.000315*		*%*		*63.0*	*50-140*			
Semi-Volatiles									
1-Methylnaphthalene	0.00933	0.00005	mg/L	ND	93.3	50-140			
2-Methylnaphthalene	0.00935	0.00005	mg/L	ND	93.5	50-140			
7H-Dibenzo[c,g]carbazole	0.00880	0.00050	mg/L	ND	88.0	50-140			
Anthracene	0.00868	0.00001	mg/L	ND	86.8	50-140			
Benzo [a] anthracene	0.00915	0.00001	mg/L	ND	91.5	50-140			
Benzo [a] pyrene	0.00814	0.00001	mg/L	ND	81.4	50-140			
Benzo [b&j] fluoranthene	0.0100	0.00005	mg/L	ND	100	50-140			
Benzo [e] pyrene	0.00922	0.00005	mg/L	ND	92.2	50-140			
Benzo [g,h,i] perylene	0.00752	0.00005	mg/L	ND	75.2	50-140			
Benzo [k] fluoranthene	0.00900	0.00005	mg/L	ND	90.0	50-140			
Benzylbutylphthalate	0.00634	0.00050	mg/L	ND	63.4	50-140			
Biphenyl	0.00890	0.00005	mg/L	ND	89.0	50-140			
Bis(2-chloroethoxy)methane	0.00809	0.00100	mg/L	ND	80.9	50-140			
Bis(2-ethylhexyl)phthalate	0.00628	0.00100	mg/L	ND	62.8	50-140			
Chrysene	0.00914	0.00005	mg/L	ND	91.4	50-140			
Dibenzo [a,h] anthracene	0.0102	0.00005	mg/L	ND	102	50-140			
Dibenzo [a,i] pyrene	0.0101	0.00050	mg/L	ND	101	50-140			
Dibenzo [a,j] acridine	0.00948	0.00050	mg/L	ND	94.8	50-140			
Diethylphthalate	0.00919	0.00100	mg/L	ND	91.9	50-140			
Di-n-butylphthalate	0.00941	0.00100	mg/L	ND	94.1	50-140			
Di-n-octylphthalate	0.00582	0.00100	mg/L	ND	58.2	50-140			
Fluoranthene	0.0102	0.00001	mg/L	ND	102	50-140			
Fluorene	0.00888	0.00005	mg/L	ND	88.8	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Indeno [1,2,3-cd] pyrene	0.00939	0.00005	mg/L	ND	93.9	50-140			
Indole	0.00906	0.00100	mg/L	ND	90.6	50-140			
Naphthalene	0.00857	0.00005	mg/L	ND	85.7	50-140			
Phenanthrene	0.00925	0.00005	mg/L	ND	92.5	50-140			
Perylene	0.00917	0.00050	mg/L	ND	91.7	50-140			
Pyrene	0.00759	0.00001	mg/L	ND	75.9	50-140			
2,4-Dichlorophenol	0.00775	0.00100	mg/L	ND	77.5	50-140			
Surrogate: 2-Fluorobiphenyl	*0.0196*		*%*		*98.1*	*50-140*			
Surrogate: Nitrobenzene-d5	*0.0164*		*%*		*81.9*	*50-140*			
Surrogate: Terphenyl-d14	*0.0196*		*%*		*97.8*	*50-140*			
Surrogate: 2,4,6-Tribromophenol	*0.0491*		*%*		*123*	*50-140*			
Surrogate: 2-Fluorophenol	*0.00342*		*%*		*8.56*	*50-140*			*S-GC*
Surrogate: Phenol-d6	*0.00545*		*%*		*13.6*	*50-140*			*S-GC*
Volatiles									
Acetone	0.0998	0.0050	mg/L	ND	99.8	50-140			
Benzene	0.0408	0.0005	mg/L	ND	102	60-130			
Bromodichloromethane	0.0411	0.0005	mg/L	ND	103	60-130			
Bromoform	0.0423	0.0005	mg/L	ND	106	60-130			
Bromomethane	0.0424	0.0005	mg/L	ND	106	50-140			
Carbon Tetrachloride	0.0402	0.0002	mg/L	ND	101	60-130			
Chlorobenzene	0.0414	0.0005	mg/L	ND	104	60-130			
Chloroethane	0.0480	0.0010	mg/L	ND	120	50-140			
Chloroform	0.0419	0.0005	mg/L	ND	105	60-130			
Chloromethane	0.0486	0.0030	mg/L	ND	121	50-140			
Dibromochloromethane	0.0433	0.0005	mg/L	ND	108	60-130			
Dichlorodifluoromethane	0.0380	0.0010	mg/L	ND	95.0	50-140			
1,2-Dibromoethane	0.0436	0.0002	mg/L	ND	109	60-130			
1,2-Dichlorobenzene	0.0407	0.0005	mg/L	ND	102	60-130			
1,3-Dichlorobenzene	0.0423	0.0005	mg/L	ND	106	60-130			
1,4-Dichlorobenzene	0.0407	0.0005	mg/L	ND	102	60-130			
1,1-Dichloroethane	0.0433	0.0005	mg/L	ND	108	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichloroethane	0.0444	0.0005	mg/L	ND	111	60-130			
1,1-Dichloroethylene	0.0424	0.0005	mg/L	ND	106	60-130			
cis-1,2-Dichloroethylene	0.0395	0.0005	mg/L	ND	98.7	60-130			
trans-1,2-Dichloroethylene	0.0346	0.0005	mg/L	ND	86.6	60-130			
1,2-Dichloropropane	0.0392	0.0005	mg/L	ND	98.0	60-130			
cis-1,3-Dichloropropylene	0.0431	0.0005	mg/L	ND	108	60-130			
trans-1,3-Dichloropropylene	0.0396	0.0005	mg/L	ND	99.0	60-130			
Ethylbenzene	0.0376	0.0005	mg/L	ND	94.1	60-130			
Hexane	0.0325	0.0010	mg/L	ND	81.3	60-130			
Methyl Ethyl Ketone (2-Butanone)	0.106	0.0050	mg/L	ND	106	50-140			
Methyl Butyl Ketone (2-Hexanone)	0.115	0.0100	mg/L	ND	115	50-140			
Methyl Isobutyl Ketone	0.110	0.0050	mg/L	ND	110	50-140			
Methyl tert-butyl ether	0.138	0.0020	mg/L	ND	138	50-140			
Methylene Chloride	0.0457	0.0050	mg/L	ND	114	60-130			
Styrene	0.0393	0.0005	mg/L	ND	98.3	60-130			
1,1,1,2-Tetrachloroethane	0.0409	0.0005	mg/L	ND	102	60-130			
1,1,2,2-Tetrachloroethane	0.0457	0.0005	mg/L	ND	114	60-130			
Tetrachloroethylene	0.0381	0.0005	mg/L	ND	95.3	60-130			
Toluene	0.0399	0.0005	mg/L	ND	99.8	60-130			
1,1,1-Trichloroethane	0.0410	0.0005	mg/L	ND	103	60-130			
1,1,2-Trichloroethane	0.0421	0.0005	mg/L	ND	105	60-130			
Trichloroethylene	0.0361	0.0005	mg/L	ND	90.2	60-130			
Trichlorofluoromethane	0.0487	0.0010	mg/L	ND	122	60-130			
1,3,5-Trimethylbenzene	0.0365	0.0005	mg/L	ND	91.2	60-130			
Vinyl chloride	0.0323	0.0005	mg/L	ND	80.8	50-140			
m,p-Xylenes	0.0807	0.0005	mg/L	ND	101	60-130			
o-Xylene	0.0388	0.0005	mg/L	ND	97.0	60-130			
Surrogate: 4-Bromofluorobenzene	*0.0790*		*%*		*98.7*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0839*		*%*		*105*	*50-140*			
Surrogate: Toluene-d8	*0.0770*		*%*		*96.2*	*50-140*			

Qualifier Notes:

Sample Qualifiers :

2: Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

QC Qualifiers:

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

S-GC Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.

- F1 range corrected for BTEX.

- F2 to F3 ranges corrected for appropriate PAHs where available.

- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.

- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

- When reported, data for F4G has been processed using a silica gel cleanup.

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Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Jason Karis-Allen

Client PO:
Project: 100117.051
Custody: 74579

Report Date: 17-Sep-2024
Order Date: 10-Sep-2024

Order #: 2437224

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2437224-01	BH24-18
2437224-02	BH24-18 (Filtered)
2437224-03	BH24-04
2437224-04	BH24-10
2437224-05	BH24-10 (Filtered)
2437224-06	BH24-16
2437224-07	BH24-16 (Filtered)

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	12-Sep-24	12-Sep-24
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	12-Sep-24	12-Sep-24
Metals, ICP-MS	EPA 200.8 - ICP-MS	16-Sep-24	16-Sep-24
Ottawa - San/Comb: SVOCs with PAHs	EPA 625 - GC-MS, extraction	11-Sep-24	12-Sep-24
pH	EPA 150.1 - pH probe @25 °C	13-Sep-24	13-Sep-24
Phosphorus, total dissolved	EPA 365.4; IC, filtration	16-Sep-24	16-Sep-24
Phosphorus, total, water	EPA 365.4 - Auto Colour, digestion	16-Sep-24	16-Sep-24
Resistivity	EPA 120.1 - probe	13-Sep-24	13-Sep-24
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	16-Sep-24	16-Sep-24
Total Suspended Solids	SM 2540D - Gravimetric	14-Sep-24	16-Sep-24
VOCs by P&T GC-MS	EPA 624 - P&T GC-MS	11-Sep-24	11-Sep-24
Volatile Suspended Solids	SM 2540D - Gravimetric, 550C	14-Sep-24	16-Sep-24

PARACEL LABORATORIES LTD.

Order #: 2437224

Certificate of Analysis

Report Date: 17-Sep-2024

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 10-Sep-2024

Client PO:

Project Description: 100117.051

	Client ID:	BH24-18	BH24-18 (Filtered)	BH24-04	BH24-10	-	-
	Sample Date:	10-Sep-24 11:40	10-Sep-24 11:40	10-Sep-24 12:25	10-Sep-24 13:25		
	Sample ID:	2437224-01	2437224-02	2437224-03	2437224-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
General Inorganics							
pH	0.1 pH Units	7.5	-	8.1	7.6	-	-
Phosphorus, total	0.01 mg/L	0.03	-	-	0.01	-	-
Phosphorus, total dissolved	0.01 mg/L	-	<0.01	-	-	-	-
Resistivity	0.01 Ohm.m	-	-	12.0	-	-	-
Total Suspended Solids	2 mg/L	7	-	-	4	-	-
Volatile Suspended Solids	2 mg/L	<2	-	-	<2	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.5	-	-	0.1	-	-
Anions							
Chloride	1 mg/L	-	-	31	-	-	-
Sulphate	1 mg/L	-	-	36	-	-	-
Metals							
Aluminum	0.010 mg/L	-	0.016	-	-	-	-
Antimony	0.001 mg/L	-	<0.001	-	-	-	-
Arsenic	0.010 mg/L	-	<0.010	-	-	-	-
Bismuth	0.005 mg/L	-	<0.005	-	-	-	-
Boron	0.050 mg/L	-	0.057	-	-	-	-
Cadmium	0.001 mg/L	-	<0.001	-	-	-	-
Chromium	0.050 mg/L	-	<0.050	-	-	-	-
Cobalt	0.001 mg/L	-	<0.001	-	-	-	-
Copper	0.005 mg/L	-	<0.005	-	-	-	-
Lead	0.001 mg/L	-	<0.001	-	-	-	-
Manganese	0.050 mg/L	-	0.609	-	-	-	-
Mercury	0.0001 mg/L	-	<0.0001	-	-	-	-
Molybdenum	0.005 mg/L	-	<0.005	-	-	-	-
Nickel	0.005 mg/L	-	<0.005	-	-	-	-

	Client ID:	BH24-18	BH24-18 (Filtered)	BH24-04	BH24-10	-	-
	Sample Date:	10-Sep-24 11:40	10-Sep-24 11:40	10-Sep-24 12:25	10-Sep-24 13:25		
	Sample ID:	2437224-01	2437224-02	2437224-03	2437224-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Metals							
Selenium	0.005 mg/L	-	<0.005	-	-	-	-
Silver	0.001 mg/L	-	<0.001	-	-	-	-
Tin	0.010 mg/L	-	<0.010	-	-	-	-
Titanium	0.010 mg/L	-	<0.010	-	-	-	-
Vanadium	0.001 mg/L	-	<0.001	-	-	-	-
Zinc	0.020 mg/L	-	<0.020	-	-	-	-
Metals - Total							
Aluminum	0.01 mg/L	0.21	-	-	0.10	-	-
Antimony	0.001 mg/L	<0.001	-	-	<0.001	-	-
Arsenic	0.01 mg/L	<0.01	-	-	<0.01	-	-
Bismuth	0.005 mg/L	<0.005	-	-	<0.005	-	-
Boron	0.05 mg/L	0.06	-	-	<0.05	-	-
Cadmium	0.001 mg/L	<0.001	-	-	<0.001	-	-
Chromium	0.05 mg/L	<0.05	-	-	<0.05	-	-
Cobalt	0.001 mg/L	<0.001	-	-	<0.001	-	-
Copper	0.005 mg/L	<0.005	-	-	<0.005	-	-
Lead	0.001 mg/L	<0.001	-	-	<0.001	-	-
Mercury	0.0001 mg/L	<0.0001	-	-	<0.0001	-	-
Manganese	0.05 mg/L	0.62	-	-	<0.05	-	-
Molybdenum	0.005 mg/L	<0.005	-	-	<0.005	-	-
Nickel	0.005 mg/L	<0.005	-	-	<0.005	-	-
Selenium	0.005 mg/L	<0.005	-	-	<0.005	-	-
Silver	0.001 mg/L	<0.001	-	-	<0.001	-	-
Tin	0.01 mg/L	<0.01	-	-	<0.01	-	-
Titanium	0.01 mg/L	<0.01	-	-	<0.01	-	-

	Client ID:	BH24-18	BH24-18 (Filtered)	BH24-04	BH24-10	-	-
	Sample Date:	10-Sep-24 11:40	10-Sep-24 11:40	10-Sep-24 12:25	10-Sep-24 13:25		
	Sample ID:	2437224-01	2437224-02	2437224-03	2437224-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Metals - Total							
Vanadium	0.001 mg/L	<0.001	-	-	<0.001	-	-
Zinc	0.02 mg/L	<0.02	-	-	<0.02	-	-
Volatiles							
Acetone	0.0050 mg/L	<0.0050	-	-	<0.0050	-	-
Benzene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Bromodichloromethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Bromoform	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Bromomethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Carbon Tetrachloride	0.0002 mg/L	<0.0002	-	-	<0.0002	-	-
Chlorobenzene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Chloroethane	0.0010 mg/L	<0.0010	-	-	<0.0010	-	-
Chloroform	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Chloromethane	0.0030 mg/L	<0.0030	-	-	<0.0030	-	-
Dibromochloromethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Dichlorodifluoromethane	0.0010 mg/L	<0.0010	-	-	<0.0010	-	-
1,2-Dibromoethane	0.0002 mg/L	<0.0002	-	-	<0.0002	-	-
1,2-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,3-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,4-Dichlorobenzene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,1-Dichloroethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,2-Dichloroethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,1-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
cis-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
trans-1,2-Dichloroethylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,2-Dichloroethylene, total	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-

	Client ID:	BH24-18	BH24-18 (Filtered)	BH24-04	BH24-10	-	-
	Sample Date:	10-Sep-24 11:40	10-Sep-24 11:40	10-Sep-24 12:25	10-Sep-24 13:25		
	Sample ID:	2437224-01	2437224-02	2437224-03	2437224-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Volatiles							
1,2-Dichloropropane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
cis-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
trans-1,3-Dichloropropylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,3-Dichloropropene, total	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Ethylbenzene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Hexane	0.0010 mg/L	<0.0010	-	-	<0.0010	-	-
Methyl Ethyl Ketone (2-Butanone)	0.0050 mg/L	<0.0050	-	-	<0.0050	-	-
Methyl Butyl Ketone (2-Hexanone)	0.0100 mg/L	<0.0100	-	-	<0.0100	-	-
Methyl Isobutyl Ketone	0.0050 mg/L	<0.0050	-	-	<0.0050	-	-
Methyl tert-butyl ether	0.0020 mg/L	<0.0020	-	-	<0.0020	-	-
Methylene Chloride	0.0050 mg/L	<0.0050	-	-	<0.0050	-	-
Styrene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,1,1,2-Tetrachloroethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,1,2,2-Tetrachloroethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Tetrachloroethylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Toluene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,1,1-Trichloroethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
1,1,2-Trichloroethane	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Trichloroethylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Trichlorofluoromethane	0.0010 mg/L	<0.0010	-	-	<0.0010	-	-
1,3,5-Trimethylbenzene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Vinyl chloride	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
m,p-Xylenes	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
o-Xylene	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-
Xylenes, total	0.0005 mg/L	<0.0005	-	-	<0.0005	-	-

	Client ID:	BH24-18	BH24-18 (Filtered)	BH24-04	BH24-10	-	-
	Sample Date:	10-Sep-24 11:40	10-Sep-24 11:40	10-Sep-24 12:25	10-Sep-24 13:25		
	Sample ID:	2437224-01	2437224-02	2437224-03	2437224-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Volatiles							
Dibromofluoromethane	Surrogate	113%	-	-	112%	-	-
Toluene-d8	Surrogate	104%	-	-	104%	-	-
4-Bromofluorobenzene	Surrogate	86.9%	-	-	86.9%	-	-
Semi-Volatiles							
1-Methylnaphthalene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
2-Methylnaphthalene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
7H-Dibenzo[c,g]carbazole	0.00050 mg/L	<0.00050	-	-	<0.00050	-	-
Anthracene	0.00001 mg/L	<0.00001	-	-	<0.00001	-	-
Benzo [a] anthracene	0.00001 mg/L	<0.00001	-	-	<0.00001	-	-
Benzo [a] pyrene	0.00001 mg/L	<0.00001	-	-	<0.00001	-	-
Benzo [b&j] fluoranthene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Benzo [e] pyrene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Benzo [g,h,i] perylene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Benzo [k] fluoranthene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Benzylbutylphthalate	0.00050 mg/L	<0.00050	-	-	<0.00050	-	-
Biphenyl	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Bis(2-chloroethoxy)methane	0.00100 mg/L	<0.00100	-	-	<0.00100	-	-
Bis(2-ethylhexyl)phthalate	0.00100 mg/L	<0.00100	-	-	<0.00100	-	-
Chrysene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Dibenzo [a,h] anthracene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Dibenzo [a,i] pyrene	0.00050 mg/L	<0.00050	-	-	<0.00050	-	-
Dibenzo [a,j] acridine	0.00050 mg/L	<0.00050	-	-	<0.00050	-	-
Diethylphthalate	0.00100 mg/L	<0.00100	-	-	<0.00100	-	-
Di-n-butylphthalate	0.00100 mg/L	<0.00100	-	-	<0.00100	-	-
Di-n-octylphthalate	0.00100 mg/L	<0.00100	-	-	<0.00100	-	-

Certificate of Analysis

Report Date: 17-Sep-2024

Client: **GEMTEC Consulting Engineers and Scientists Limited**

Order Date: 10-Sep-2024

Client PO:

Project Description: 100117.051

	Client ID:	BH24-18	BH24-18 (Filtered)	BH24-04	BH24-10	-	-
	Sample Date:	10-Sep-24 11:40	10-Sep-24 11:40	10-Sep-24 12:25	10-Sep-24 13:25		
	Sample ID:	2437224-01	2437224-02	2437224-03	2437224-04		
	Matrix:	Ground Water	Ground Water	Ground Water	Ground Water		
	MDL/Units						
Semi-Volatiles							
Fluoranthene	0.00001 mg/L	<0.00001	-	-	<0.00001	-	-
Fluorene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Indeno [1,2,3-cd] pyrene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Indole	0.00100 mg/L	<0.00100	-	-	<0.00100	-	-
Naphthalene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Phenanthrene	0.00005 mg/L	<0.00005	-	-	<0.00005	-	-
Perylene	0.00050 mg/L	<0.00050	-	-	<0.00050	-	-
Pyrene	0.00001 mg/L	<0.00001	-	-	<0.00001	-	-
2,4-Dichlorophenol	0.00100 mg/L	<0.00100	-	-	<0.00100	-	-
PAHs, Total	0.0025 mg/L	<0.0025	-	-	<0.0025	-	-
2-Fluorobiphenyl	Surrogate	81.0%	-	-	82.1%	-	-
Nitrobenzene-d5	Surrogate	89.8%	-	-	95.9%	-	-
Terphenyl-d14	Surrogate	99.0%	-	-	92.5%	-	-
2,4,6-Tribromophenol	Surrogate	109%	-	-	95.5%	-	-
2-Fluorophenol	Surrogate	17.4% [3]	-	-	27.3% [3]	-	-
Phenol-d6	Surrogate	25.5% [3]	-	-	38.1% [3]	-	-

	Client ID:	BH24-10 (Filtered)	BH24-16	BH24-16 (Filtered)		-	-
	Sample Date:	10-Sep-24 13:25	10-Sep-24 14:00	10-Sep-24 14:00			
	Sample ID:	2437224-05	2437224-06	2437224-07			
	Matrix:	Ground Water	Ground Water	Ground Water			
	MDL/Units						
General Inorganics							
pH	0.1 pH Units	-	6.5	-	-	-	-
Phosphorus, total	0.01 mg/L	-	0.07	-	-	-	-
Phosphorus, total dissolved	0.01 mg/L	0.01	-	<0.01	-	-	-
Total Suspended Solids	2 mg/L	-	142	-	-	-	-
Volatile Suspended Solids	2 mg/L	-	40	-	-	-	-
Total Kjeldahl Nitrogen	0.1 mg/L	-	5.0	-	-	-	-
Metals							
Aluminum	0.010 mg/L	0.010	-	0.094	-	-	-
Antimony	0.001 mg/L	<0.001	-	<0.001	-	-	-
Arsenic	0.010 mg/L	<0.010	-	<0.010	-	-	-
Bismuth	0.005 mg/L	<0.005	-	<0.005	-	-	-
Boron	0.050 mg/L	<0.050	-	<0.050	-	-	-
Cadmium	0.001 mg/L	<0.001	-	<0.001	-	-	-
Chromium	0.050 mg/L	<0.050	-	<0.050	-	-	-
Cobalt	0.001 mg/L	<0.001	-	0.015	-	-	-
Copper	0.005 mg/L	<0.005	-	<0.005	-	-	-
Lead	0.001 mg/L	<0.001	-	<0.001	-	-	-
Manganese	0.050 mg/L	<0.050	-	33.7	-	-	-
Mercury	0.0001 mg/L	<0.0001	-	<0.0001	-	-	-
Molybdenum	0.005 mg/L	<0.005	-	<0.005	-	-	-
Nickel	0.005 mg/L	<0.005	-	0.006	-	-	-
Selenium	0.005 mg/L	<0.005	-	<0.005	-	-	-
Silver	0.001 mg/L	<0.001	-	<0.001	-	-	-
Tin	0.010 mg/L	<0.010	-	<0.010	-	-	-
Titanium	0.010 mg/L	<0.010	-	<0.010	-	-	-

	Client ID:	BH24-10 (Filtered)	BH24-16	BH24-16 (Filtered)		-	-
	Sample Date:	10-Sep-24 13:25	10-Sep-24 14:00	10-Sep-24 14:00			
	Sample ID:	2437224-05	2437224-06	2437224-07			
	Matrix:	Ground Water	Ground Water	Ground Water			
	MDL/Units						
Metals							
Vanadium	0.001 mg/L	<0.001	-	0.006	-	-	-
Zinc	0.020 mg/L	<0.020	-	<0.020	-	-	-
Metals - Total							
Aluminum	0.01 mg/L	-	2.68	-	-	-	-
Antimony	0.001 mg/L	-	<0.001	-	-	-	-
Arsenic	0.01 mg/L	-	<0.01	-	-	-	-
Bismuth	0.005 mg/L	-	<0.005	-	-	-	-
Boron	0.05 mg/L	-	<0.05	-	-	-	-
Cadmium	0.001 mg/L	-	<0.001	-	-	-	-
Chromium	0.05 mg/L	-	<0.05	-	-	-	-
Cobalt	0.001 mg/L	-	0.017	-	-	-	-
Copper	0.005 mg/L	-	<0.005	-	-	-	-
Lead	0.001 mg/L	-	<0.001	-	-	-	-
Manganese	0.05 mg/L	-	33.1	-	-	-	-
Mercury	0.0001 mg/L	-	<0.0001	-	-	-	-
Molybdenum	0.005 mg/L	-	<0.005	-	-	-	-
Nickel	0.005 mg/L	-	0.009	-	-	-	-
Selenium	0.005 mg/L	-	<0.005	-	-	-	-
Silver	0.001 mg/L	-	<0.001	-	-	-	-
Tin	0.01 mg/L	-	<0.01	-	-	-	-
Titanium	0.01 mg/L	-	0.16	-	-	-	-
Vanadium	0.001 mg/L	-	0.019	-	-	-	-
Zinc	0.02 mg/L	-	<0.02	-	-	-	-
Volatiles							
Acetone	0.0050 mg/L	-	<0.0050	-	-	-	-

	Client ID:	BH24-10 (Filtered)	BH24-16	BH24-16 (Filtered)		-	-
	Sample Date:	10-Sep-24 13:25	10-Sep-24 14:00	10-Sep-24 14:00			
	Sample ID:	2437224-05	2437224-06	2437224-07			
	Matrix:	Ground Water	Ground Water	Ground Water			
	MDL/Units						
Volatiles							
Benzene	0.0005 mg/L	-	<0.0005	-	-	-	-
Bromodichloromethane	0.0005 mg/L	-	<0.0005	-	-	-	-
Bromoform	0.0005 mg/L	-	<0.0005	-	-	-	-
Bromomethane	0.0005 mg/L	-	<0.0005	-	-	-	-
Carbon Tetrachloride	0.0002 mg/L	-	<0.0002	-	-	-	-
Chlorobenzene	0.0005 mg/L	-	<0.0005	-	-	-	-
Chloroethane	0.0010 mg/L	-	<0.0010	-	-	-	-
Chloroform	0.0005 mg/L	-	<0.0005	-	-	-	-
Chloromethane	0.0030 mg/L	-	<0.0030	-	-	-	-
Dibromochloromethane	0.0005 mg/L	-	<0.0005	-	-	-	-
Dichlorodifluoromethane	0.0010 mg/L	-	<0.0010	-	-	-	-
1,2-Dibromoethane	0.0002 mg/L	-	<0.0002	-	-	-	-
1,2-Dichlorobenzene	0.0005 mg/L	-	<0.0005	-	-	-	-
1,3-Dichlorobenzene	0.0005 mg/L	-	<0.0005	-	-	-	-
1,4-Dichlorobenzene	0.0005 mg/L	-	<0.0005	-	-	-	-
1,1-Dichloroethane	0.0005 mg/L	-	<0.0005	-	-	-	-
1,2-Dichloroethane	0.0005 mg/L	-	<0.0005	-	-	-	-
1,1-Dichloroethylene	0.0005 mg/L	-	<0.0005	-	-	-	-
cis-1,2-Dichloroethylene	0.0005 mg/L	-	<0.0005	-	-	-	-
trans-1,2-Dichloroethylene	0.0005 mg/L	-	<0.0005	-	-	-	-
1,2-Dichloroethylene, total	0.0005 mg/L	-	<0.0005	-	-	-	-
1,2-Dichloropropane	0.0005 mg/L	-	<0.0005	-	-	-	-
cis-1,3-Dichloropropylene	0.0005 mg/L	-	<0.0005	-	-	-	-
trans-1,3-Dichloropropylene	0.0005 mg/L	-	<0.0005	-	-	-	-
1,3-Dichloropropene, total	0.0005 mg/L	-	<0.0005	-	-	-	-

	Client ID:	BH24-10 (Filtered)	BH24-16	BH24-16 (Filtered)		-	-
	Sample Date:	10-Sep-24 13:25	10-Sep-24 14:00	10-Sep-24 14:00			
	Sample ID:	2437224-05	2437224-06	2437224-07			
	Matrix:	Ground Water	Ground Water	Ground Water			
	MDL/Units						
Volatiles							
Ethylbenzene	0.0005 mg/L	-	<0.0005	-	-	-	-
Hexane	0.0010 mg/L	-	<0.0010	-	-	-	-
Methyl Ethyl Ketone (2-Butanone)	0.0050 mg/L	-	<0.0050	-	-	-	-
Methyl Butyl Ketone (2-Hexanone)	0.0100 mg/L	-	<0.0100	-	-	-	-
Methyl Isobutyl Ketone	0.0050 mg/L	-	<0.0050	-	-	-	-
Methyl tert-butyl ether	0.0020 mg/L	-	<0.0020	-	-	-	-
Methylene Chloride	0.0050 mg/L	-	<0.0050	-	-	-	-
Styrene	0.0005 mg/L	-	<0.0005	-	-	-	-
1,1,1,2-Tetrachloroethane	0.0005 mg/L	-	<0.0005	-	-	-	-
1,1,2,2-Tetrachloroethane	0.0005 mg/L	-	<0.0005	-	-	-	-
Tetrachloroethylene	0.0005 mg/L	-	<0.0005	-	-	-	-
Toluene	0.0005 mg/L	-	0.0183	-	-	-	-
1,1,1-Trichloroethane	0.0005 mg/L	-	<0.0005	-	-	-	-
1,1,2-Trichloroethane	0.0005 mg/L	-	<0.0005	-	-	-	-
Trichloroethylene	0.0005 mg/L	-	<0.0005	-	-	-	-
Trichlorofluoromethane	0.0010 mg/L	-	<0.0010	-	-	-	-
1,3,5-Trimethylbenzene	0.0005 mg/L	-	<0.0005	-	-	-	-
Vinyl chloride	0.0005 mg/L	-	<0.0005	-	-	-	-
m,p-Xylenes	0.0005 mg/L	-	<0.0005	-	-	-	-
o-Xylene	0.0005 mg/L	-	<0.0005	-	-	-	-
Xylenes, total	0.0005 mg/L	-	<0.0005	-	-	-	-
Dibromofluoromethane	Surrogate	-	111%	-	-	-	-
Toluene-d8	Surrogate	-	103%	-	-	-	-
4-Bromofluorobenzene	Surrogate	-	85.6%	-	-	-	-
Semi-Volatiles							

	Client ID:	BH24-10 (Filtered)	BH24-16	BH24-16 (Filtered)		-	-
	Sample Date:	10-Sep-24 13:25	10-Sep-24 14:00	10-Sep-24 14:00			
	Sample ID:	2437224-05	2437224-06	2437224-07			
	Matrix:	Ground Water	Ground Water	Ground Water			
	MDL/Units						
Semi-Volatiles							
1-Methylnaphthalene	0.00005 mg/L	-	<0.00005	-	-	-	-
2-Methylnaphthalene	0.00005 mg/L	-	<0.00005	-	-	-	-
7H-Dibenzo[c,g]carbazole	0.00050 mg/L	-	<0.00050	-	-	-	-
Anthracene	0.00001 mg/L	-	<0.00001	-	-	-	-
Benzo [a] anthracene	0.00001 mg/L	-	<0.00001	-	-	-	-
Benzo [a] pyrene	0.00001 mg/L	-	<0.00001	-	-	-	-
Benzo [b&j] fluoranthene	0.00005 mg/L	-	<0.00005	-	-	-	-
Benzo [e] pyrene	0.00005 mg/L	-	<0.00005	-	-	-	-
Benzo [g,h,i] perylene	0.00005 mg/L	-	<0.00005	-	-	-	-
Benzo [k] fluoranthene	0.00005 mg/L	-	<0.00005	-	-	-	-
Benzylbutylphthalate	0.00050 mg/L	-	<0.00050	-	-	-	-
Biphenyl	0.00005 mg/L	-	<0.00005	-	-	-	-
Bis(2-chloroethoxy)methane	0.00100 mg/L	-	<0.00100	-	-	-	-
Bis(2-ethylhexyl)phthalate	0.00100 mg/L	-	<0.00100	-	-	-	-
Chrysene	0.00005 mg/L	-	<0.00005	-	-	-	-
Dibenzo [a,h] anthracene	0.00005 mg/L	-	<0.00005	-	-	-	-
Dibenzo [a,i] pyrene	0.00050 mg/L	-	<0.00050	-	-	-	-
Dibenzo [a,j] acridine	0.00050 mg/L	-	<0.00050	-	-	-	-
Diethylphthalate	0.00100 mg/L	-	<0.00100	-	-	-	-
Di-n-butylphthalate	0.00100 mg/L	-	<0.00100	-	-	-	-
Di-n-octylphthalate	0.00100 mg/L	-	<0.00100	-	-	-	-
Fluoranthene	0.00001 mg/L	-	<0.00001	-	-	-	-
Fluorene	0.00005 mg/L	-	<0.00005	-	-	-	-
Indeno [1,2,3-cd] pyrene	0.00005 mg/L	-	<0.00005	-	-	-	-
Indole	0.00100 mg/L	-	<0.00100	-	-	-	-

	Client ID:	BH24-10 (Filtered)	BH24-16	BH24-16 (Filtered)		-	-
	Sample Date:	10-Sep-24 13:25	10-Sep-24 14:00	10-Sep-24 14:00			
	Sample ID:	2437224-05	2437224-06	2437224-07			
	Matrix:	Ground Water	Ground Water	Ground Water			
	MDL/Units						
Semi-Volatiles							
Naphthalene	0.00005 mg/L	-	<0.00005	-	-	-	-
Phenanthrene	0.00005 mg/L	-	<0.00005	-	-	-	-
Perylene	0.00050 mg/L	-	<0.00050	-	-	-	-
Pyrene	0.00001 mg/L	-	<0.00001	-	-	-	-
2,4-Dichlorophenol	0.00100 mg/L	-	<0.00100	-	-	-	-
PAHs, Total	0.0025 mg/L	-	<0.0025	-	-	-	-
2-Fluorobiphenyl	Surrogate	-	86.0%	-	-	-	-
Nitrobenzene-d5	Surrogate	-	107%	-	-	-	-
Terphenyl-d14	Surrogate	-	87.0%	-	-	-	-
2,4,6-Tribromophenol	Surrogate	-	107%	-	-	-	-
2-Fluorophenol	Surrogate	-	50.0%	-	-	-	-
Phenol-d6	Surrogate	-	67.8%	-	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	1	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
Phosphorus, total	ND	0.01	mg/L					
Phosphorus, total dissolved	ND	0.01	mg/L					
Resistivity	ND	0.01	Ohm.m					
Total Suspended Solids	ND	2	mg/L					
Volatile Suspended Solids	ND	2	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Metals								
Aluminum	ND	0.010	mg/L					
Antimony	ND	0.001	mg/L					
Arsenic	ND	0.010	mg/L					
Bismuth	ND	0.005	mg/L					
Boron	ND	0.050	mg/L					
Cadmium	ND	0.001	mg/L					
Chromium	ND	0.050	mg/L					
Cobalt	ND	0.001	mg/L					
Copper	ND	0.005	mg/L					
Lead	ND	0.001	mg/L					
Mercury	ND	0.0001	mg/L					
Manganese	ND	0.050	mg/L					
Molybdenum	ND	0.005	mg/L					
Nickel	ND	0.005	mg/L					
Selenium	ND	0.005	mg/L					
Silver	ND	0.001	mg/L					
Tin	ND	0.010	mg/L					
Titanium	ND	0.010	mg/L					
Vanadium	ND	0.001	mg/L					
Zinc	ND	0.020	mg/L					
Metals - Total								
Aluminum	ND	0.01	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Antimony	ND	0.001	mg/L					
Arsenic	ND	0.01	mg/L					
Bismuth	ND	0.005	mg/L					
Boron	ND	0.05	mg/L					
Cadmium	ND	0.001	mg/L					
Chromium	ND	0.05	mg/L					
Cobalt	ND	0.001	mg/L					
Copper	ND	0.005	mg/L					
Lead	ND	0.001	mg/L					
Mercury	ND	0.0001	mg/L					
Manganese	ND	0.05	mg/L					
Molybdenum	ND	0.005	mg/L					
Nickel	ND	0.005	mg/L					
Selenium	ND	0.005	mg/L					
Silver	ND	0.001	mg/L					
Tin	ND	0.01	mg/L					
Titanium	ND	0.01	mg/L					
Vanadium	ND	0.001	mg/L					
Zinc	ND	0.02	mg/L					
Semi-Volatiles								
1-Methylnaphthalene	ND	0.00005	mg/L					
2-Methylnaphthalene	ND	0.00005	mg/L					
7H-Dibenzo[c,g]carbazole	ND	0.00050	mg/L					
Anthracene	ND	0.00001	mg/L					
Benzo [a] anthracene	ND	0.00001	mg/L					
Benzo [a] pyrene	ND	0.00001	mg/L					
Benzo [b&j] fluoranthene	ND	0.00005	mg/L					
Benzo [e] pyrene	ND	0.00005	mg/L					
Benzo [g,h,i] perylene	ND	0.00005	mg/L					
Benzo [k] fluoranthene	ND	0.00005	mg/L					
Benzylbutylphthalate	ND	0.00050	mg/L					
Biphenyl	ND	0.00005	mg/L					
Bis(2-chloroethoxy)methane	ND	0.00100	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Bis(2-ethylhexyl)phthalate	ND	0.00100	mg/L					
Chrysene	ND	0.00005	mg/L					
Dibenzo [a,h] anthracene	ND	0.00005	mg/L					
Dibenzo [a,i] pyrene	ND	0.00050	mg/L					
Dibenzo [a,j] acridine	ND	0.00050	mg/L					
Diethylphthalate	ND	0.00100	mg/L					
Di-n-butylphthalate	ND	0.00100	mg/L					
Di-n-octylphthalate	ND	0.00100	mg/L					
Fluoranthene	ND	0.00001	mg/L					
Fluorene	ND	0.00005	mg/L					
Indeno [1,2,3-cd] pyrene	ND	0.00005	mg/L					
Indole	ND	0.00100	mg/L					
Naphthalene	ND	0.00005	mg/L					
Phenanthrene	ND	0.00005	mg/L					
Perylene	ND	0.00050	mg/L					
Pyrene	ND	0.00001	mg/L					
2,4-Dichlorophenol	ND	0.00100	mg/L					
Surrogate: 2-Fluorobiphenyl	*0.0153*		*%*	*76.6*	*50-140*			
Surrogate: Nitrobenzene-d5	*0.0175*		*%*	*87.6*	*50-140*			
Surrogate: Terphenyl-d14	*0.0179*		*%*	*89.6*	*50-140*			
Surrogate: 2,4,6-Tribromophenol	*0.0343*		*%*	*85.8*	*50-140*			
Surrogate: 2-Fluorophenol	*0.00811*		*%*	*20.3*	*50-140*			S-GC
Surrogate: Phenol-d6	*0.0139*		*%*	*34.7*	*50-140*			S-GC
Volatiles								
Acetone	ND	0.0050	mg/L					
Benzene	ND	0.0005	mg/L					
Bromodichloromethane	ND	0.0005	mg/L					
Bromoform	ND	0.0005	mg/L					
Bromomethane	ND	0.0005	mg/L					
Carbon Tetrachloride	ND	0.0002	mg/L					
Chlorobenzene	ND	0.0005	mg/L					
Chloroethane	ND	0.0010	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.0005	mg/L					
Chloromethane	ND	0.0030	mg/L					
Dibromochloromethane	ND	0.0005	mg/L					
Dichlorodifluoromethane	ND	0.0010	mg/L					
1,2-Dibromoethane	ND	0.0002	mg/L					
1,2-Dichlorobenzene	ND	0.0005	mg/L					
1,3-Dichlorobenzene	ND	0.0005	mg/L					
1,4-Dichlorobenzene	ND	0.0005	mg/L					
1,1-Dichloroethane	ND	0.0005	mg/L					
1,2-Dichloroethane	ND	0.0005	mg/L					
1,1-Dichloroethylene	ND	0.0005	mg/L					
cis-1,2-Dichloroethylene	ND	0.0005	mg/L					
trans-1,2-Dichloroethylene	ND	0.0005	mg/L					
1,2-Dichloroethylene, total	ND	0.0005	mg/L					
1,2-Dichloropropane	ND	0.0005	mg/L					
cis-1,3-Dichloropropylene	ND	0.0005	mg/L					
trans-1,3-Dichloropropylene	ND	0.0005	mg/L					
1,3-Dichloropropene, total	ND	0.0005	mg/L					
Ethylbenzene	ND	0.0005	mg/L					
Hexane	ND	0.0010	mg/L					
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L					
Methyl Butyl Ketone (2-Hexanone)	ND	0.0100	mg/L					
Methyl Isobutyl Ketone	ND	0.0050	mg/L					
Methyl tert-butyl ether	ND	0.0020	mg/L					
Methylene Chloride	ND	0.0050	mg/L					
Styrene	ND	0.0005	mg/L					
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L					
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L					
Tetrachloroethylene	ND	0.0005	mg/L					
Toluene	ND	0.0005	mg/L					
1,1,1-Trichloroethane	ND	0.0005	mg/L					
1,1,2-Trichloroethane	ND	0.0005	mg/L					
Trichloroethylene	ND	0.0005	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Trichlorofluoromethane	ND	0.0010	mg/L					
1,3,5-Trimethylbenzene	ND	0.0005	mg/L					
Vinyl chloride	ND	0.0005	mg/L					
m,p-Xylenes	ND	0.0005	mg/L					
o-Xylene	ND	0.0005	mg/L					
Xylenes, total	ND	0.0005	mg/L					
Surrogate: 4-Bromofluorobenzene	*0.0708*		*%*	*88.5*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0881*		*%*	*110*	*50-140*			
Surrogate: Toluene-d8	*0.0841*		*%*	*105*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	1	mg/L	ND			NC	20	
Sulphate	ND	1	mg/L	ND			NC	10	
General Inorganics									
pH	8.0	0.1	pH Units	8.0			0.3	3.3	
Phosphorus, total	0.030	0.01	mg/L	0.027			9.1	15	
Phosphorus, total dissolved	ND	0.01	mg/L	ND			NC	10	
Resistivity	7.01	0.01	Ohm.m	6.95			0.7	20	
Total Suspended Solids	ND	2	mg/L	ND			NC	10	
Volatile Suspended Solids	38.0	4	mg/L	40.0			5.1	10	
Total Kjeldahl Nitrogen	0.50	0.1	mg/L	0.47			7.0	16	
Metals									
Aluminum	ND	0.010	mg/L	0.0161			NC	20	
Antimony	ND	0.001	mg/L	ND			NC	20	
Arsenic	ND	0.010	mg/L	ND			NC	20	
Bismuth	ND	0.005	mg/L	ND			NC	20	
Boron	0.0538	0.050	mg/L	0.0572			6.1	20	
Cadmium	ND	0.001	mg/L	ND			NC	20	
Chromium	ND	0.050	mg/L	ND			NC	20	
Cobalt	ND	0.001	mg/L	ND			NC	20	
Copper	ND	0.005	mg/L	ND			NC	20	
Lead	ND	0.001	mg/L	ND			NC	20	
Mercury	ND	0.0001	mg/L	ND			NC	20	
Manganese	0.591	0.050	mg/L	0.609			3.1	20	
Molybdenum	ND	0.005	mg/L	ND			NC	20	
Nickel	ND	0.005	mg/L	ND			NC	20	
Selenium	ND	0.005	mg/L	ND			NC	20	
Silver	ND	0.001	mg/L	ND			NC	20	
Tin	ND	0.010	mg/L	ND			NC	20	
Titanium	ND	0.010	mg/L	ND			NC	20	
Vanadium	ND	0.001	mg/L	ND			NC	20	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Zinc	ND	0.020	mg/L	ND			NC	20	
Metals - Total									
Aluminum	0.23	0.01	mg/L	0.21			6.5	20	
Antimony	ND	0.001	mg/L	ND			NC	20	
Arsenic	ND	0.01	mg/L	ND			NC	20	
Bismuth	ND	0.005	mg/L	ND			NC	20	
Boron	0.06	0.05	mg/L	0.06			1.8	20	
Cadmium	ND	0.001	mg/L	ND			NC	20	
Chromium	ND	0.05	mg/L	ND			NC	20	
Cobalt	ND	0.001	mg/L	ND			NC	20	
Copper	ND	0.005	mg/L	ND			NC	20	
Lead	ND	0.001	mg/L	ND			NC	20	
Mercury	ND	0.0001	mg/L	ND			NC	20	
Manganese	0.622	0.05	mg/L	0.622			0.1	20	
Molybdenum	0.006	0.005	mg/L	ND			NC	20	
Nickel	ND	0.005	mg/L	ND			NC	20	
Selenium	ND	0.005	mg/L	ND			NC	20	
Silver	ND	0.001	mg/L	ND			NC	20	
Tin	ND	0.01	mg/L	ND			NC	20	
Titanium	0.011	0.01	mg/L	ND			NC	20	
Vanadium	ND	0.001	mg/L	ND			NC	20	
Zinc	ND	0.02	mg/L	ND			NC	20	
Volatiles									
Acetone	ND	0.0050	mg/L	ND			NC	30	
Benzene	ND	0.0005	mg/L	ND			NC	30	
Bromodichloromethane	ND	0.0005	mg/L	ND			NC	30	
Bromoform	ND	0.0005	mg/L	ND			NC	30	
Bromomethane	ND	0.0005	mg/L	ND			NC	30	
Carbon Tetrachloride	ND	0.0002	mg/L	ND			NC	30	
Chlorobenzene	ND	0.0005	mg/L	ND			NC	30	
Chloroethane	ND	0.0010	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroform	ND	0.0005	mg/L	ND			NC	30	
Chloromethane	ND	0.0030	mg/L	ND			NC	30	
Dibromochloromethane	ND	0.0005	mg/L	ND			NC	30	
Dichlorodifluoromethane	ND	0.0010	mg/L	ND			NC	30	
1,2-Dibromoethane	ND	0.0002	mg/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,3-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,4-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
cis-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,2-Dichloroethylene	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichloropropane	ND	0.0005	mg/L	ND			NC	30	
cis-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
trans-1,3-Dichloropropylene	ND	0.0005	mg/L	ND			NC	30	
Ethylbenzene	ND	0.0005	mg/L	ND			NC	30	
Hexane	ND	0.0010	mg/L	ND			NC	30	
Methyl Ethyl Ketone (2-Butanone)	ND	0.0050	mg/L	ND			NC	30	
Methyl Butyl Ketone (2-Hexanone)	ND	0.0100	mg/L	ND			NC	30	
Methyl Isobutyl Ketone	ND	0.0050	mg/L	ND			NC	30	
Methyl tert-butyl ether	ND	0.0020	mg/L	ND			NC	30	
Methylene Chloride	ND	0.0050	mg/L	ND			NC	30	
Styrene	ND	0.0005	mg/L	ND			NC	30	
1,1,1,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
Tetrachloroethylene	ND	0.0005	mg/L	ND			NC	30	
Toluene	0.0156	0.0005	mg/L	0.0183			15.8	30	
1,1,1-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
1,1,2-Trichloroethane	ND	0.0005	mg/L	ND			NC	30	
Trichloroethylene	ND	0.0005	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Trichlorofluoromethane	ND	0.0010	mg/L	ND			NC	30	
1,3,5-Trimethylbenzene	ND	0.0005	mg/L	ND			NC	30	
Vinyl chloride	ND	0.0005	mg/L	ND			NC	30	
m,p-Xylenes	ND	0.0005	mg/L	ND			NC	30	
o-Xylene	ND	0.0005	mg/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*0.0699*		*%*		*87.3*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0893*		*%*		*112*	*50-140*			
Surrogate: Toluene-d8	*0.0828*		*%*		*104*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	9.87	1	mg/L	ND	98.7	70-124			
Sulphate	9.56	1	mg/L	ND	95.6	74-126			
General Inorganics									
Phosphorus, total	0.947	0.01	mg/L	0.027	92.0	80-120			
Phosphorus, total dissolved	0.95	0.01	mg/L	ND	95.3	80-120			
Total Suspended Solids	20.0	2	mg/L	ND	93.0	75-125			
Total Kjeldahl Nitrogen	1.46	0.1	mg/L	0.47	98.7	81-126			
Metals									
Aluminum	58.6	0.010	mg/L	1.6	114	80-120			
Arsenic	51.5	0.010	mg/L	0.08	103	80-120			
Bismuth	40.3	0.005	mg/L	0.04	80.4	80-120			
Boron	60.9	0.050	mg/L	5.7	110	80-120			
Cadmium	52.4	0.001	mg/L	0.002	105	80-120			
Chromium	56.0	0.050	mg/L	ND	112	80-120			
Cobalt	54.4	0.001	mg/L	0.06	109	80-120			
Copper	52.5	0.005	mg/L	0.1	105	80-120			
Lead	50.9	0.001	mg/L	0.006	102	80-120			
Mercury	0.00290	0.0001	mg/L	ND	96.8	70-130			
Manganese	117	0.050	mg/L	60.9	112	80-120			
Molybdenum	50.7	0.005	mg/L	0.3	101	80-120			
Nickel	54.0	0.005	mg/L	0.2	108	80-120			
Selenium	50.9	0.005	mg/L	0.1	102	80-120			
Silver	48.6	0.001	mg/L	0.008	97.2	80-120			
Tin	51.4	0.010	mg/L	0.05	103	80-120			
Titanium	60.6	0.010	mg/L	0.04	121	80-120			QM-07
Vanadium	56.2	0.001	mg/L	0.05	112	80-120			
Zinc	50.8	0.020	mg/L	0.3	101	80-120			
Metals - Total									
Aluminum	76.1	0.01	mg/L	21.1	110	80-120			
Arsenic	47.3	0.01	mg/L	0.096	94.5	80-120			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bismuth	46.2	0.005	mg/L	0.086	92.2	80-120			
Boron	59.2	0.05	mg/L	5.61	107	80-120			
Cadmium	49.1	0.001	mg/L	0.002	98.1	80-120			
Chromium	53.1	0.05	mg/L	0.060	106	80-120			
Cobalt	51.3	0.001	mg/L	0.064	102	80-120			
Copper	49.7	0.005	mg/L	0.150	99.0	80-120			
Lead	46.8	0.001	mg/L	0.035	93.5	80-120			
Mercury	0.0028	0.0001	mg/L	ND	93.1	70-130			
Manganese	111	0.05	mg/L	62.2	97.4	80-120			
Molybdenum	48.4	0.005	mg/L	0.367	96.0	80-120			
Nickel	51.2	0.005	mg/L	0.208	102	80-120			
Selenium	45.9	0.005	mg/L	0.131	91.5	80-120			
Silver	46.2	0.001	mg/L	0.007	92.5	80-120			
Tin	49.5	0.01	mg/L	0.074	98.9	80-120			
Titanium	59.2	0.01	mg/L	0.981	116	80-120			
Vanadium	52.1	0.001	mg/L	0.091	104	80-120			
Zinc	46.6	0.02	mg/L	0.380	92.4	80-120			
Semi-Volatiles									
1-Methylnaphthalene	0.00666	0.00005	mg/L	ND	66.6	50-140			
2-Methylnaphthalene	0.00850	0.00005	mg/L	ND	85.0	50-140			
7H-Dibenzo[c,g]carbazole	0.00622	0.00050	mg/L	ND	62.2	50-140			
Anthracene	0.00661	0.00001	mg/L	ND	66.1	50-140			
Benzo [a] anthracene	0.00700	0.00001	mg/L	ND	70.0	50-140			
Benzo [a] pyrene	0.00672	0.00001	mg/L	ND	67.2	50-140			
Benzo [b&j] fluoranthene	0.0110	0.00005	mg/L	ND	110	50-140			
Benzo [e] pyrene	0.00739	0.00005	mg/L	ND	73.9	50-140			
Benzo [g,h,i] perylene	0.00728	0.00005	mg/L	ND	72.8	50-140			
Benzo [k] fluoranthene	0.00803	0.00005	mg/L	ND	80.3	50-140			
Benzylbutylphthalate	0.00567	0.00050	mg/L	ND	56.7	50-140			
Biphenyl	0.00645	0.00005	mg/L	ND	64.5	50-140			
Bis(2-chloroethoxy)methane	0.00748	0.00100	mg/L	ND	74.8	50-140			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Bis(2-ethylhexyl)phthalate	0.00501	0.00100	mg/L	ND	50.1	50-140			
Chrysene	0.00739	0.00005	mg/L	ND	73.9	50-140			
Dibenzo [a,h] anthracene	0.00785	0.00005	mg/L	ND	78.5	50-140			
Dibenzo [a,i] pyrene	0.00696	0.00050	mg/L	ND	69.6	50-140			
Dibenzo [a,j] acridine	0.00582	0.00050	mg/L	ND	58.2	50-140			
Diethylphthalate	0.00642	0.00100	mg/L	ND	64.2	50-140			
Di-n-butylphthalate	0.00810	0.00100	mg/L	ND	81.0	50-140			
Di-n-octylphthalate	0.00587	0.00100	mg/L	ND	58.7	50-140			
Fluoranthene	0.00804	0.00001	mg/L	ND	80.4	50-140			
Fluorene	0.00702	0.00005	mg/L	ND	70.2	50-140			
Indeno [1,2,3-cd] pyrene	0.00719	0.00005	mg/L	ND	71.9	50-140			
Indole	0.00717	0.00100	mg/L	ND	71.7	50-140			
Naphthalene	0.00646	0.00005	mg/L	ND	64.6	50-140			
Phenanthrene	0.00750	0.00005	mg/L	ND	75.0	50-140			
Perylene	0.00698	0.00050	mg/L	ND	69.8	50-140			
Pyrene	0.00592	0.00001	mg/L	ND	59.2	50-140			
2,4-Dichlorophenol	0.00598	0.00100	mg/L	ND	59.8	50-140			
Surrogate: 2-Fluorobiphenyl	*0.0123*		*%*		*61.7*	*50-140*			
Surrogate: Nitrobenzene-d5	*0.0143*		*%*		*71.6*	*50-140*			
Surrogate: Terphenyl-d14	*0.0143*		*%*		*71.3*	*50-140*			
Surrogate: 2,4,6-Tribromophenol	*0.0281*		*%*		*70.2*	*50-140*			
Surrogate: 2-Fluorophenol	*0.00495*		*%*		*12.4*	*50-140*			*S-GC*
Surrogate: Phenol-d6	*0.00834*		*%*		*20.9*	*50-140*			*S-GC*
Volatiles									
Acetone	0.0953	0.0050	mg/L	ND	95.3	50-140			
Benzene	0.0376	0.0005	mg/L	ND	93.9	60-130			
Bromodichloromethane	0.0380	0.0005	mg/L	ND	94.9	60-130			
Bromoform	0.0317	0.0005	mg/L	ND	79.3	60-130			
Bromomethane	0.0340	0.0005	mg/L	ND	85.0	50-140			
Carbon Tetrachloride	0.0360	0.0002	mg/L	ND	89.9	60-130			
Chlorobenzene	0.0358	0.0005	mg/L	ND	89.4	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chloroethane	0.0444	0.0010	mg/L	ND	111	50-140			
Chloroform	0.0382	0.0005	mg/L	ND	95.5	60-130			
Chloromethane	0.0377	0.0030	mg/L	ND	94.3	50-140			
Dibromochloromethane	0.0359	0.0005	mg/L	ND	89.7	60-130			
Dichlorodifluoromethane	0.0423	0.0010	mg/L	ND	106	50-140			
1,2-Dibromoethane	0.0382	0.0002	mg/L	ND	95.6	60-130			
1,2-Dichlorobenzene	0.0348	0.0005	mg/L	ND	86.9	60-130			
1,3-Dichlorobenzene	0.0371	0.0005	mg/L	ND	92.8	60-130			
1,4-Dichlorobenzene	0.0362	0.0005	mg/L	ND	90.5	60-130			
1,1-Dichloroethane	0.0412	0.0005	mg/L	ND	103	60-130			
1,2-Dichloroethane	0.0412	0.0005	mg/L	ND	103	60-130			
1,1-Dichloroethylene	0.0427	0.0005	mg/L	ND	107	60-130			
cis-1,2-Dichloroethylene	0.0371	0.0005	mg/L	ND	92.8	60-130			
trans-1,2-Dichloroethylene	0.0424	0.0005	mg/L	ND	106	60-130			
1,2-Dichloropropane	0.0363	0.0005	mg/L	ND	90.8	60-130			
cis-1,3-Dichloropropylene	0.0385	0.0005	mg/L	ND	96.2	60-130			
trans-1,3-Dichloropropylene	0.0382	0.0005	mg/L	ND	95.6	60-130			
Ethylbenzene	0.0339	0.0005	mg/L	ND	84.7	60-130			
Hexane	0.0324	0.0010	mg/L	ND	81.1	60-130			
Methyl Ethyl Ketone (2-Butanone)	0.0977	0.0050	mg/L	ND	97.7	50-140			
Methyl Butyl Ketone (2-Hexanone)	0.0970	0.0100	mg/L	ND	97.0	50-140			
Methyl Isobutyl Ketone	0.0977	0.0050	mg/L	ND	97.7	50-140			
Methyl tert-butyl ether	0.0833	0.0020	mg/L	ND	83.3	50-140			
Methylene Chloride	0.0440	0.0050	mg/L	ND	110	60-130			
Styrene	0.0322	0.0005	mg/L	ND	80.4	60-130			
1,1,1,2-Tetrachloroethane	0.0331	0.0005	mg/L	ND	82.7	60-130			
1,1,2,2-Tetrachloroethane	0.0373	0.0005	mg/L	ND	93.3	60-130			
Tetrachloroethylene	0.0310	0.0005	mg/L	ND	77.6	60-130			
Toluene	0.0362	0.0005	mg/L	ND	90.5	60-130			
1,1,1-Trichloroethane	0.0356	0.0005	mg/L	ND	89.0	60-130			
1,1,2-Trichloroethane	0.0404	0.0005	mg/L	ND	101	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Trichloroethylene	0.0335	0.0005	mg/L	ND	83.8	60-130			
Trichlorofluoromethane	0.0468	0.0010	mg/L	ND	117	60-130			
1,3,5-Trimethylbenzene	0.0327	0.0005	mg/L	ND	81.8	60-130			
Vinyl chloride	0.0293	0.0005	mg/L	ND	73.2	50-140			
m,p-Xylenes	0.0689	0.0005	mg/L	ND	86.1	60-130			
o-Xylene	0.0333	0.0005	mg/L	ND	83.3	60-130			
Surrogate: 4-Bromofluorobenzene	*0.0608*		*%*		*76.0*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0896*		*%*		*112*	*50-140*			
Surrogate: Toluene-d8	*0.0811*		*%*		*101*	*50-140*			

Qualifier Notes:

Login Qualifiers :

Sample - Filtered and preserved by Paracel upon receipt at the laboratory - Metals by ICP-MS, and mercury; as directed by the client.

Applies to Samples: BH24-18 (Filtered), BH24-10 (Filtered), BH24-16 (Filtered)

Sample Qualifiers :

3: Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

QC Qualifiers:

QM-07 The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

S-GC Surrogate recovery outside of control limits. The data was accepted based on valid recovery of the remaining surrogate.

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

APPENDIX F

Bedrock Core Photos

BOREHOLE: 24-2
BORING DATE: JULY 18, 2024
DEPTH: 2.81 to 4.40 mbgs

GEMTEC
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Project

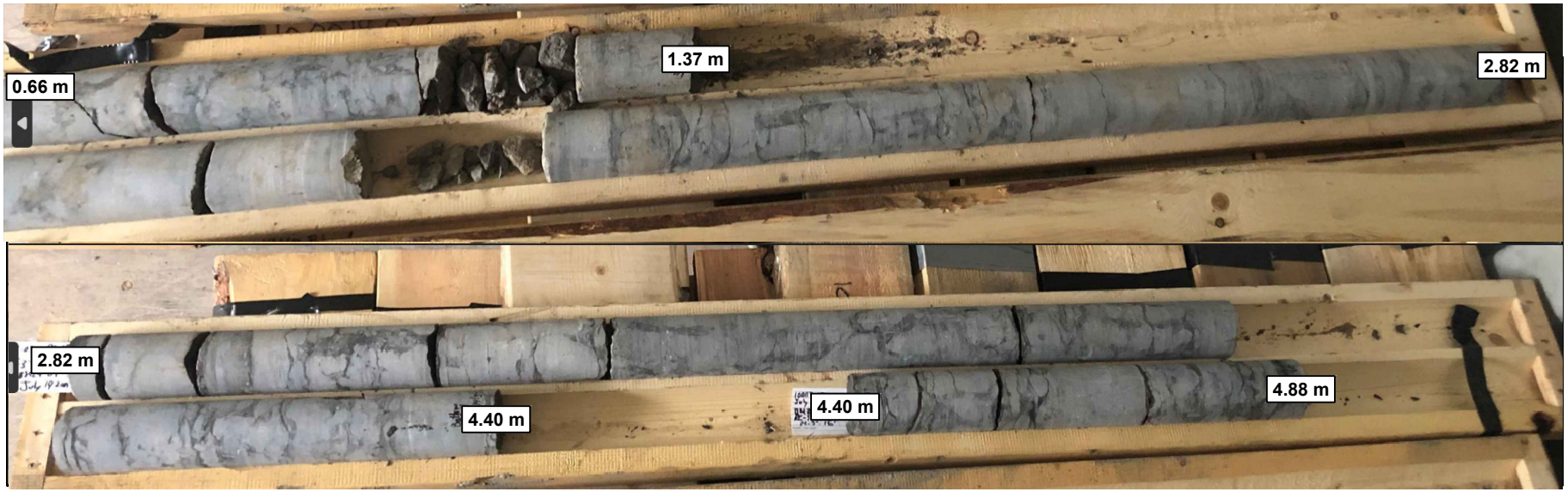
CASSELMAN
(MAIN SEWAGE PUMPING STATIONS (SPS))

FIGURE F1

File No.
100117.051

ROCKCORE PHOTOGRAPH
BOREHOLE 24-2

BOREHOLE: 24-4
BORING DATE: JULY 19, 2024
DEPTH: 0.66 to 4.88 mbgs



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Project

CASSELMAN
(MAIN SEWAGE PUMPING STATIONS (SPS))

FIGURE F2

File No.
100117.051

ROCKCORE PHOTOGRAPH
BOREHOLE 24-4

BOREHOLE: 24-18 RC-8
BORING DATE: JULY 18, 2024
DEPTH: 4.62 to 5.92 mbgs

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CASSELMAN
(MAIN SEWAGE PUMPING STATIONS (SPS))

FIGURE F3

File No.
100117.051

ROCKCORE PHOTOGRAPH
BOREHOLE 24-18 RC-8

BOREHOLE: 24-18 RC-9
BORING DATE: JULY 18, 2024
DEPTH: 5.92 to 7.39 mbgs

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Project
CASSELMAN
(MAIN SEWAGE PUMPING STATIONS (SPS))

FIGURE F4

File No.
100117.051

ROCKCORE PHOTOGRAPH
BOREHOLE 24-18 RC-9

BOREHOLE: 24-18 RC-10
BORING DATE: JULY 18, 2024
DEPTH: 7.39 to 8.79 mbgs

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FIGURE F5

File No.
100117.051

ROCKCORE PHOTOGRAPH
BOREHOLE 24-18 RC-10

BOREHOLE: 22-01
BORING DATE: DATE
DEPTH: D1 to D2 mbgs

D1 m	### m	### m	### m	### m	D2m

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Project

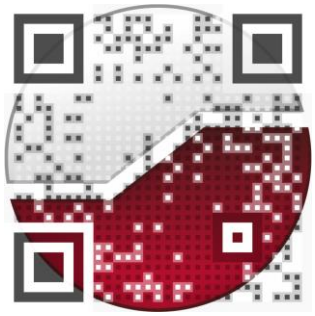
CASSELMAN
(MAIN SEWAGE PUMPING STATIONS (SPS))

FIGURE F

File No.
100117.051

ROCKCORE PHOTOGRAPH
BOREHOLE #####

experience • knowledge • integrity



civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité

Casselman Main Sewage Pumping Station Upgrade

Corporation of the Village of Casselman

Attachment 2 – Soil Screening Report

GEMTEC
www.gemtec.ca

Soil Screening Report
Casselman Main Sewage Pumping Station Upgrades
Casselman, Ontario

GEMTEC Project: 100117.051

GEMTEC
www.gemtec.ca

Submitted to:

J.L. Richards & Associates Limited
1000 – 343 Preston Street
Ottawa, Ontario
K1S 1N4

Soil Screening Report
Casselman Main Sewage Pumping Station Upgrades
Casselman, Ontario

January 13, 2025
GEMTEC Project: 100117.051

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Ottawa, ON, Canada
K2K 2A9

January 13, 2025 File: 100117.051

J.L. Richards & Associates Limited
1000 – 343 Preston Street
Ottawa, Ontario
K1S 1N4

Attention: Mr. Matthew Marcuccio, P.Eng, Environmental Engineer

Re: Soil Screening Report
Casselman Main Sewage Pumping Station Upgrades
Casselman, Ontario

Enclosed is our Soil Screening Report for the excess soil to be generated for the Casselman Main Sewage Pumping Station Upgrades in Casselman, Ontario. This report was prepared by Mohit Bhargav, M.Sc.E., EIT, and reviewed by Daniel Elliot, P.Geo., QP_{ESA}.

Mohit Bhargav, M.Sc.E., EIT
Environmental Scientist

Daniel Elliot, P.Geo., QP_{ESA}
Senior Environmental Geoscientist

MB/DE

Enclosures
N:\Projects\100100\100117.051\05_Technical Work\Excess Soil\Soil Screening Report\100117.051_RPT_SoilScreeningReport_2025-01-13_Rev1.docx

EXECUTIVE SUMMARY

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by J.L. Richards & Associates Limited (JLR) to conduct an Environmental Excess Soil Investigation (Field Investigation) for the Casselman Main Sewage Pumping Station (SPS) Upgrades in Casselman, Ontario (herein referred to as the 'Site'). The Site location is shown in Figure A1 to Figure A3, Appendix A. GEMTEC understands that the anticipated excess soil volume to be generated from the Site is 7,000 cubic metres (m^3).

The Field Investigation was carried out in conjunction with the Geotechnical and Hydrogeological Investigation between July 18, 2024 and July 26, 2024. During that time, a total of seventeen (17) boreholes and probe holes were advanced at the Site.

The selection of applicable provincial standards for comparison to soil analytical results is based on a review of various receiving site characteristics as well as potential soil management and disposal options considered as part of the project.

Soil from samples collected at BH24-1, BH24-2, BH24-4, BH24-8, BH24-12, BH24-15, and BH24-16 met Table 1 – Background Site Condition Standards for agricultural and other land uses. Soil samples from the remaining locations met Table 2.1 – Full Depth Generic Excess Soil Quality Standards for residential/parkland/institutional land uses.

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LIST OF APPENDICES

1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by J.L. Richards & Associates Limited (JLR) to conduct an Environmental Excess Soil Investigation (Field Investigation) for the Casselman Main Sewage Pumping Station (SPS) Upgrades in Casselman, Ontario (herein referred to as the 'Site'). The Site location is shown in Figure A1 to Figure A3, Appendix A.

GEMTEC understands that the anticipated excess soil volume to be generated from the Site is 7,000 cubic metres (m^3). GEMTEC completed a preliminary soil quality screening investigation as part of this undertaking. This preliminary soil quality screening investigation will not be sufficient to satisfy the Section 8 planning document requirements under Ontario Regulation 406/19 – On-Site and Excess Soil Management (O.Reg. 406/19). However, all samples collected during the investigation can be used to satisfy the requirements.

2.0 BACKGROUND

2.1 Project Description

Based on information provided to GEMTEC by JLR the project will consist of upgrading the existing Casselman Main Sewage Pumping Station (SPS). Details of the proposed works are shown on drawings C101 to C109 inclusive, titled "Forcemain Plan & Profile" dated September 2024 and prepared by J.L. Richards. The upgrading works include:

- Installation of a new 525 millimetre diameter concrete overflow pipe and flapper type gate value. The overflow pipe will be installed from an existing manhole on the north side of the SPS, with the flapper gate outletting into the South Nation River a relatively short distance to the north of the SPS. The details of this component of the works are to be confirmed., however shallow excavations within about 3 metres depth are anticipated.
- Installation of a new 400 millimetre diameter HDPE forcemain from the existing SPS at the intersection of Brisson Street and Principale Street to the location identified as Lagoon Cell 1 East Berm. The length of forcemain to be installed is about 2,000 metres. The alignment is expected to be along the same alignment as the existing forcemain (within road allowances and existing easements). The forcemain will be constructed within Laurier Street.

It is also understood full road width reconstruction is being considered along Brisson Street, and that trench reinstatement of the roadway is being considered along Laurier Street, the Sainte-Euphémie Catholic Elementary School, and the lagoon access road.

Material and installation details related to the proposed Casselman Main SPS Upgrades are available under separate report titled 'Geotechnical and Hydrogeological Investigation,

Casselman Main Sewage Pumping Station Upgrades, Casselman, Ontario' prepared by GEMTEC in September 2024.

Based on the project information available, this project will require registration as described under Section 8 of O.Reg. 406/19 for the following reasons:

- The estimated volume of soil to become excess is greater than 2,000 m^3 and the project area includes community and industrial property uses;
- The project area includes enhanced investigation properties; and,
- The infrastructure being installed is new.

If the volume of soil expected to become excess changes the requirement for registration should be reviewed.

2.2 Environmental Records

No historical environmental reports were available for review prior to the Field Investigation. Local experience and publicly available aerial photographs were reviewed to inform the anticipated contaminants of potential concern (COPCs) to be investigated during the Field Investigation.

2.3 Scope of Work

GEMTEC performed the following tasks:

- Task 1 – Geotechnical and Hydrogeological Investigation;
- Task 2 – Environmental Excess Soil Investigation; and,
- Task 3 – Soil Screening Report.

3.0 METHODOLOGY

3.1 General

The Field Investigation (Task 2) was carried out in conjunction with the Geotechnical and Hydrogeological Investigation (Task 1) between July 18, 2024 and July 26, 2024. During that time, a total of seventeen (17) boreholes and probe holes were advanced at the Site. The details of the Field Investigation are provided in Table 3.1.

Table 3.1: Details of the Field Investigation

Borehole/ Probe Holes	Borehole Location	Ground Surface Elevation (m)	Borehole Depth (metres below ground surface (m bgs))	Purpose of Borehole/Probe Hole
24-1	Pumping Station and Brisson Street	61.9	3.8 (Refusal)	Excess Soil Investigation

Borehole/ Probe Holes	Borehole Location	Ground Surface Elevation (m)	Borehole Depth (metres below ground surface (m bgs))	Purpose of Borehole/Probe Hole
MW24-1	Pumping Station and Brisson Street	62.0	4.0 (Refusal)	Geotechnical Investigation
24-2	Pumping Station and Brisson Street	59.2	4.4	Excess Soil Investigation
24-3 (Probe)	Pumping Station and Brisson Street	58.6	1.9 (Refusal)	Geotechnical Investigation
24-4	Pumping Station and Brisson Street	58.3	4.9	Excess Soil Investigation
24-5	Removed from work program due to unlocatable sanitary forcemain.			
24-6	Field / School Yard	63.9	4.42	Excess Soil Investigation
24-7 (Probe)	Field / School Yard	64.4	4.6	Geotechnical Investigation
24-8	Field / School Yard	65.8	4.4	Excess Soil Investigation
24-9 (Probe)	Field / School Yard	66.5	4.6	Geotechnical Investigation
24-10	Field / School Yard	65.4	4.4	Excess Soil Investigation
24-11 (Probe)	Laurier Street	65.4	5.2	Geotechnical Investigation
24-12	Laurier Street	64.8	5.2	Excess Soil Investigation
24-13	Removed from work program due to unlocatable sanitary forcemain.			
24-14 (Probe)	Lagoon	67.7	4.6	Geotechnical Investigation
24-15	Lagoon	67.8	4.4	Excess Soil Investigation
24-16	Lagoon	67.6	6.7	Excess Soil Investigation
24-17	Lagoon	67.7	4.4	Excess Soil Investigation
24-18	Pumping Station and Brisson Street	61.5	8.8	Excess Soil Investigation

3.2 Soil Drilling

The boreholes were advanced using a truck and a track mounted drill rig supplied and operated by George Downing Estate Drilling Ltd. of Grenville-Sur-La-Rouge, Quebec. The boreholes (for

Excess Soil Investigation) were advanced to depths of approximately 8.8 m bgs across the proposed construction alignment.

3.3 Soil Sampling

The Field Investigation was conducted in general accordance with O.Reg. 406/19 and O.Reg. 153/04, as amended.

The Field Investigation was conducted by a member of GEMTEC's engineering staff acting under the direction of a QP_{ESA}. Soil samples were collected following the *Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario (MOE, 1996)*. Soil samples were split in the field into two components. One component was placed into laboratory-prepared containers with minimal headspace as well as a pre-measured vial of methanol and stored in a cooler for laboratory analysis. The second component was placed inside a plastic bag for field screening. Soil screening included a description of the soil and noting the presence of any staining, odour and/or debris.

Clean gloves were worn and changed between each sample interval to prevent cross contamination. Soil samples were inspected in the field for visual, tactile, and olfactory evidence of impact, and, following a period of equilibration to ambient temperature, soil sample vapours were screened using a dual sensor combustible gas indicator (CGI) and photoionization detector (PID). This instrument measures a concentration of total combustible gas, calibrated to known concentrations of isobutylene and hexane. The instrument operates in the methane elimination mode. The detection limit of the instrument ranges from 0 to 11,000 ppm (i.e., 100 % LEL of hexane). The CGI has an accuracy of 25 ppm below 1,000 ppm and 5% of the lower explosive limit (LEL) between 1,000 ppm and 100% LEL.

The field investigation included the submission of eleven discrete soil samples and five leachate samples. The leachate samples included four modified Synthetic Precipitation Leaching Procedure (mSPLP) and one Toxicity Characteristic Leaching Procedure (TCLP). Soil samples were selected based on visual, tactile, and olfactory observations from the Field Investigation. Soil samples were submitted for analysis to AGAT Laboratories (AGAT) under standard chain of custody protocols, in accordance with GEMTEC Quality Assurance/Quality Control (QA/QC) procedures.

4.0 SELECTION OF REGULATORY CRITERIA

The selection of applicable provincial standards for comparison to soil analytical results is based on a review of various receiving site characteristics as well as potential soil management and disposal options considered as part of the project. It is understood that the construction project will have the potential for the excavated soils to be reused off-Site. Therefore, soil analytical results were compared to applicable provincial standards considering these requirements.

Soil Quality Standards for Reuse Off-Site in Ontario

Based on the above discussion, the following provincial standards were selected to assess the soil analytical results for potential reuse off-Site.

- MECP Table 1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Full Depth Background Site Condition Standards for Agricultural or Other Property Use.
- MECP Table 1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Leachate Screening Levels for Excess Soil Reuse for Agricultural or Other Property Use.
- MECP Table 2.1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Full Depth ESQS in a Potable Ground Water Condition for Residential / Parkland / Institutional (RPI) Property Use.
- MECP Table 2.1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Leachate Screening Levels for Full Depth Excess Soil in a Potable Ground Water Condition for RPI Property Use.
- MECP Table 3.1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Full Depth ESQS in a Non-Potable Ground Water Condition for Industrial / Commercial / Community (ICC) Property Use.
- MECP Table 3.1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Leachate Screening Levels for Full Depth Excess Soil in a Non-Potable Ground Water Condition for ICC Property Use.

The following provincial standards were considered to be applicable to the TCLP analytical results obtained during the Field Investigation:

- MECP O.Reg. 558/347 Schedule 4, Leachate Quality Criteria, to evaluate waste classification (hazardous or non-hazardous waste).

5.0 SOIL QUALITY RESULTS

5.1 Site Stratigraphy

The general soil stratigraphy based on borehole locations is provided below:

5.1.1 Pumping Station and Brisson Street (BH24-1 to BH24-4, and BH24-18)

The general soil stratigraphy at BH24-1 to BH24-3 was asphaltic concrete underlain by grey, crushed sand and gravel with trace silt followed by silty clay and glacial till. Shallow bedrock was encountered at BH24-4.

Fill material was encountered below the gravel roadway structure at BH24-2 and BH24-3, and below the topsoil at boreholes 24-18. The fill material generally consisted of brown silty sand with varying amounts of gravel, silt, and clay. Boulders were inferred in the fill material at BH24-18. The fill material at boreholes 24-3 consisted of grey gravel with some sand.

5.1.2 Field / School Yard (BH24-6 to BH24-10)

The general soil stratigraphy at BH24-6 and BH24-8 was topsoil underlain by silty clay and glacial till. Fill material underlain by a former topsoil layer was also encountered below the topsoil at BH24-8. The fill material consisted of brown silty clay with trace sand.

The general stratigraphy at BH24-10 was asphaltic concrete underlain by grey, crushed sand and gravel with trace silt (base/subbase material) followed by silty clay and glacial till.

5.1.3 Laurier Street (BH24-12)

The general stratigraphy at BH24-12 was asphaltic concrete underlain by grey, crushed sand and gravel with trace silt (base material), and brown sand and gravel with trace to some silt (subbase material). A layer of fill material was encountered below the road structure and consisted of light brown silty sand underlain by a layer of former topsoil, silty clay, glacial till and sand.

5.1.4 Lagoon (BH24-15 to BH24-17)

The general stratigraphy at BH24-15 to BH24-17 were topsoil underlain by fill material. The fill material generally consisted of grey brown silty sand to sand with some silt, trace amounts of organic material, and contained variable amounts of clay and gravel followed by silty clay. Additionally, grey sandy silt was encountered at BH24-15 below the fill material.

The detailed soil stratigraphy is provided on the Borehole Logs, Appendix B.

5.2 Soil Analytical Results

A summary of exceedances for the soil analytical results to the applicable ESQS is provided in Table 5.1. Detailed soil analytical tables are provided in Table C.1 to Table C.4, Appendix C. Analytical results are visualized in Figure A4 to Figure A6, Appendix A.

Table 5.1: Summary of Soil Analytical Results

Soil Samples	Depth of samples (m bgs)	Analysis	Exceedances compared to MECP Table 1 SCS	Exceedances compared to MECP Table 2.1 RPI ESQS	Exceedances compared to MECP Table 3.1 RPI ESQS
BH24-1 SS1	0.15 - 0.76	M&Is, PAHs, PHC F1-F4, BTEX	SAR	--	--
BH24-2 SS3	1.52 - 2.13	M&Is, PHC F1-F4, BTEX	Chromium, EC, SAR	EC	--
BH24-4 SS1	0.00 - 0.61	M&Is, PAHs, PHC F1-F4, BTEX	SAR	--	--
BH24-6 SA3	1.52 - 2.13	M&Is, PAHs, PHC F1-F4, BTEX	Barium, Chromium, Cobalt, Nickel, Vanadium	Barium, Cobalt, Vanadium	Vanadium
BH24-8 SA5	3.04 - 3.65	M&Is, PHC F1-F4, BTEX	--	--	--
BH24-10 SS3	1.52 - 2.13	M&Is, PHC F1-F4, BTEX	Barium, Chromium, Cobalt, Nickel, Vanadium, EC, SAR	Vanadium, EC	Vanadium
BH24-12 SS2	0.76 - 1.37	M&Is, PAHs, PHC F1-F4, BTEX	SAR	--	--
BH24-15 SA3	1.52 - 2.13	M&Is, PAHs, PHC F1-F4, BTEX	--	--	--
BH24-16 SS3	1.52 - 2.13	M&Is, PAHs, PHC F1-F4, BTEX	--	--	--
BH24-17 SS4	2.28 - 2.89	M&Is, PHC F1-F4, BTEX	Chromium, Cobalt, Nickel, SAR	--	--
BH24-18 SS6	3.81 - 4.42	M&Is, PHC F1-F4, VOCs	SAR	--	--

Notes:

1. m bgs – metres below ground surface
2. M&Is – Metals and Inorganics
3. VOCs – Volatile Organic Compounds
4. BTEX – Benzene, Toluene, Ethylbenzene, and Xylene
5. PHC F1-F4 – Petroleum Hydrocarbon F1-F4
6. PAHs – Polycyclic Aromatic Hydrocarbons
7. EC – Electrical Conductivity
8. SAR – Sodium Adsorption Ratio
9. MECP Table 1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil

Quality Standards", February 2024. Full Depth Background Site Condition Standards for Agricultural or Other Property Use.
10. MECP Table 2.1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Full Depth ESQS in a Potable Ground Water Condition for RPI Property Use.
11. MECP Table 3.1: Ontario Ministry of the Environment, Conservation and Parks, "Rules for Soil Management and Excess Soil Quality Standards", February 2024. Full Depth ESQS in a Non-Potable Ground Water Condition for ICC Property Use.

No exceedances were identified for the leachate analysis samples for mSPLP and TCLP samples. The soils are classified as nonhazardous and can be disposed off at a MECP licensed landfill.

Based on salting activities (during winter months) in proximity of the sampling locations at the Site (along right of ways), exceedances of EC and SAR with green text should not be considered contamination for soil remaining at the Site. These exceedances should also be reviewed by a QP of the receiving site to determine suitability for reuse of salt impacted soils. Potential reuse of excess soils may be contingent on the material not being used in landscaped areas with sensitive vegetation and plant species due to the elevated EC and SAR levels. The use of the excess soil at other sites must meet the receiving site's analytical and site-specific instrument requirements, MECP ESQS for imported materials, and limitations on reuse of salt impacted soils as outlined in the Rules Document. Additional discussion about reuse of salt impacted soils is available in Section 5.3.

SAR values exceeding Table 1 at BH24-17 and BH24-18 are not expected to be attributable to road salting activities due to the depth of the samples and the soil type. There is evidence within Sterling et al. (2023) to support elevated EC and SAR levels as naturally occurring due to the Champlain Sea deposits. It is GEMTEC's opinion that SAR exceeding Table 1 at BH24-17 and BH24-18 are not a concern, however, this should be confirmed by a potential reuse site owner and/or QP operating on the reuse site's behalf.

Samples from native materials had elevated concentrations of naturally occurring metals (blue text) as reported by Sterling et al. (2023). Concentrations of barium, cobalt, chromium, and vanadium in clay samples from the Champlain Sea deposit were compared to the 2023 report "Background Metals in Champlain Sea Sediments: Updated from 2019 Drilling and Sampling Program" (Geofirma, 2023). GEMTEC referenced this document to determine if the reported concentrations exceeded MECP ESQS. Consequently, the exceedances of barium, cobalt, chromium, and vanadium in soil samples from the Site should be considered naturally occurring, as the concentrations are below the proposed geo-regional values. Additional discussion about reuse of soils with local background concentration is available in Section 5.4.

5.3 Discussion about Salt Impacts

As the Site is included as part of a roadway, salt impacts in soil were anticipated. Based on guidance provided in Section D, Part 1. (3) of the Rules Document Salt impacted excess soil may only be placed at a reuse site if one or more of the following conditions apply:

- Where it is reasonable to expect that the soil will be affected by the same chemicals as a result of continued application of a substance for the safety of vehicular or pedestrian traffic under conditions of snow or ice;
- At any industrial or commercial use property;
- At any residential, parkland, institutional, or community use property so long as:
    - The excess soil is buried at least 1.5 metres below the surface of the soil; or
    - A landscape plan as described in the Rules Document has been created by a defined person under O.Reg. 406/19.
- At any agricultural use property so long as:
    - The excess soil is buried at least 1.5 metres below the surface of the soil; or
    - An area that will not be vegetated and only where the soil is used to achieve a grade necessary for construction of buildings, such as barns or greenhouses, or the installation of a driveway or parking area.

Despite the scenarios above, salt-impacted excess soil shall not be finally placed:

- Within 30 metres of a waterbody; or,
- Within 100 metres of a potable water well or area with an intended property use that may require a potable water well; or,
- On lands that will be used for growing crops or pasturing livestock unless the excess soil is placed 1.5 metres or greater below the soil surface.

5.4 Naturally Occurring Metals

In accordance with the Rules document, beneficial reuse of soil with naturally occurring elevated metals where the concentrations of said metals are within the range typically found in the soil at the reuse site is permitted. Accordingly, as elevated metals are typical in the clays throughout eastern Ontario (Champlain Sea Clay Area), if these same soils are confirmed to be present at the intended receiving site, reuse of these soils within such areas is permissible providing there are no other exceedances of other ESQS parameters (bulk or leachate) that would preclude reuse of the soils at the intended receiving site. As such, soils may be reused at a beneficial reuse site such that stipulations on reuse of soil with 'local background concentrations' as outlined in the Rules Document is adhered to and pending confirmation of suitability for reuse and acceptance from the receiving site and their QP_{ESA}.

5.5 Quality Assurance/Quality Control

5.5.1 Analytical Laboratory QA/QC

Soil samples were submitted to AGAT during the Field Investigation. AGAT completed a variety of internal QA/QC measures on the submitted soil samples. AGAT is accredited by the Standards Council of Canada (SCC) in cooperation with the Canadian Association of Laboratory Accreditation (CALA) for specific environmental tests listed in the scope of accreditation approved

by the SCC and registered with CALA. AGAT is also accredited to the ISO/IEC 17025 standard and employ in-house quality assurance and quality control programs to govern sample analysis including the analysis of method blanks, spiked blanks, and the analysis of duplicates (10%) for each sample batch.

The AGAT report did not note any QA/QC issues in the certificates of analysis. The laboratory certificates of analysis are provided in Appendix D.

5.5.2 QA/QC Summary

Based on the measures discussed above, sample collection and handling protocols are considered acceptable and associated analytical results are considered reliable. The sample collection methods and duplicates do not suggest inconsistencies in the field collection or in the laboratory analysis methods.

6.0 CONCLUSIONS

GEMTEC makes the following conclusions based on the soil analytical results obtained during the Field Investigation:

- Excess soil from BH24-1, BH24-2, BH24-4, BH24-8, BH24-12, BH24-15, and BH25-16 meets Table 1 Agricultural or Other property uses with restrictions related to salt-impacted soils and local background conditions related to elevated metal concentrations in naturally occurring clays.
- Excess soil from BH24-6, BH24-10, bh24-17, and BH24-18 meets Table 2.1 RPI property uses with restrictions related to salt-impacted soils and local background conditions related to elevated metal concentrations in naturally occurring clays.

Based on these conclusions, GEMTEC recommends the following:

- Excess soil generated in the vicinity of BH24-1, BH24-2, BH24-4, BH24-8, BH24-12, BH24-15, and BH25-16 can be reused at any receiving site so long as salt-impacted soil restrictions and local background condition considerations are observed.
- The excess soil from BH24-6, BH24-10, BH24-17, and BH24-18 should be used at either Table 2.1 RPI/ICC receiving site or Table 3.1 ICC receiving site so long as salt-impacted soil restrictions and local background condition considerations are observed.
- Planning studies required by O.Reg. 406/19 should be undertaken prior to tendering and construction work in order to maintain compliance with the applicable environmental regulations.

The recommendation is based on discrete sampling locations and may not be representative of the conditions between sampling locations. Should indications of contamination be identified during construction, additional sampling is recommended.

7.0 LIMITATION OF LIABILITY

This report and the work referred to within it has been undertaken by GEMTEC Consulting Engineers and Scientists Limited for J.L. Richards & Associates Limited. It is intended for the exclusive use of J.L. Richards & Associates Limited. This report may not be relied upon by any other person or entity without the express written consent of GEMTEC Consulting Engineers and Scientists Limited and J.L. Richards & Associates Limited. Nothing in this report is intended to provide a legal opinion.

The investigation undertaken by GEMTEC with respect to this report and any conclusions or recommendations made in this report reflect the best judgements of GEMTEC based on the Site conditions observed during the investigations undertaken at the date(s) identified in the report and on the information available at the time the report was prepared. This report has been prepared for the application noted and it is based, in part, on visual observations made at the Site, stockpile conditions at the storage location and laboratory analyses of specific chemical parameters and material during a specific time interval, all as described in the report. Unless otherwise stated, the findings contained in this report cannot be extrapolated or extended to previous or future Site conditions, portions of the Site that were unavailable for direct investigation, subsurface locations on the Site that were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Chemical parameters other than those addressed by the investigation described in this report may exist in soil and groundwater elsewhere on the Site, the chemical parameters addressed in the report may exist in soil and groundwater at other locations at the Site that were not investigated and concentrations of the chemical parameters addressed which are different than those reported may exist at other locations on the Site than those from where the samples were taken.

Should new information become available during future work, including excavations, borings, or other studies, GEMTEC should be requested to review the information and, if necessary, re-assess the conclusions presented herein.

8.0 REFERENCES

Geofirma. “Elevated Background Metals in Champlain Sea Sediments: Updated from 2019 Drilling and Sampling Program” (Geofirma, 2023).

Ontario Ministry of the Environment and Climate Change (MOECC). Guidance on sampling and analytical methods for use at contaminated sites in Ontario. Revised December 1996.

Ontario Ministry of the Environment, Conservation and Parks (MECP). Management of Excess Soil – A Guide for Best Management Practices. October 26, 2021.

Ontario Ministry of the Environment, Laboratory Services Branch (MOE). Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality. March 09, 2004, amended as of July 1, 2011 and as of February 19, 2021.

Ontario Ministry of the Environment, Conservation and Parks (MECP). Ontario Regulation 153/04, Made under the Environmental Protection Act, Part XV.1 – Records of Site Condition. October 31, 2011, updated January 1, 2014.

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Ontario Ministry of the Environment, Conservation and Parks (MECP). Soil, ground water and sediment standards made under the Environmental Protection Act, Part XV.1. October 31, 2011 updated January 1, 2014.

Ontario Ministry of the Environment, Conservation and Parks (MECP). Ontario Regulation 406/19, – On-site and Excess Soil Management. December 2019, amended April 2024.

Ontario Ministry of the Environment, Conservation and Parks (MECP). Rules for Soil Management and Excess Soil Quality Standards. February 2024.

9.0 CLOSURE

We trust this letter provides sufficient information for your present purposes. If you have any questions concerning this letter, please do not hesitate to contact our office.

Sincerely,

Mohit Bhargav, M.Sc.E., EIT
Environmental Scientist

Daniel Elliot, P.Geo., QP_{ESA}
Senior Environmental Geoscientist

MB/DE

APPENDIX A

Figures

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KEY PLAN

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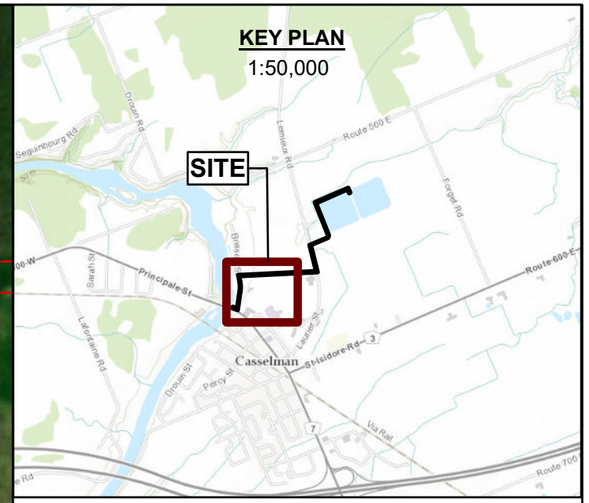

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE LOCATION

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N
2. Survey Reference based on PRS579626392983
   Easting: 476040.80m
   Northing: 5012925.07m
   Elevation: 78.42m
2. Geographic dataset source: Ontario GeoHub.
3. Contains information licensed under the Open Government Licence – Ontario.
4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:

1:2,000 Meters

0 27.5 55 110 165

Drawing: BOREHOLE LOCATION PLAN

Client: J. L. RICHARDS & ASSOCIATES LIMITED

Project: CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	D.E.
Project No.	100117.051	Revision No.	0
Date	JANUARY 2025	**FIGURE A1**	

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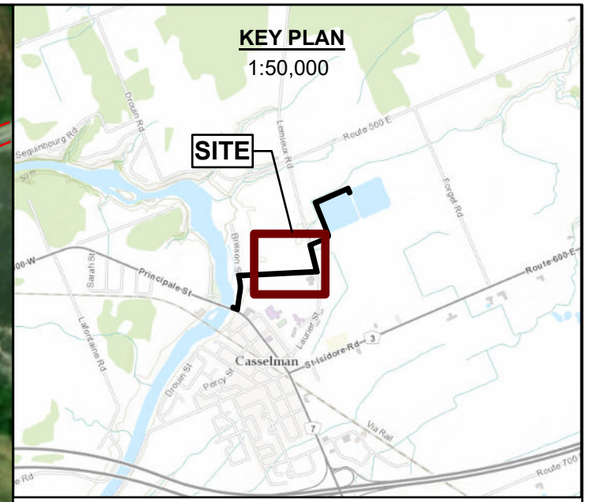

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE LOCATION

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N
2. Survey Reference based on PRS579626392983
   Easting: 476040.80m
   Northing: 5012925.07m
   Elevation: 78.42m
2. Geographic dataset source: Ontario GeoHub.
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4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:

1:2,000 Meters

0 27.5 55 110 165

Drawing

BOREHOLE LOCATION PLAN

Client:

J. L. RICHARDS & ASSOCIATES LIMITED

Project

CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	D.E.
Project No.	100117.051	Revision No.	0
Date	JANUARY 2025		**FIGURE A2**

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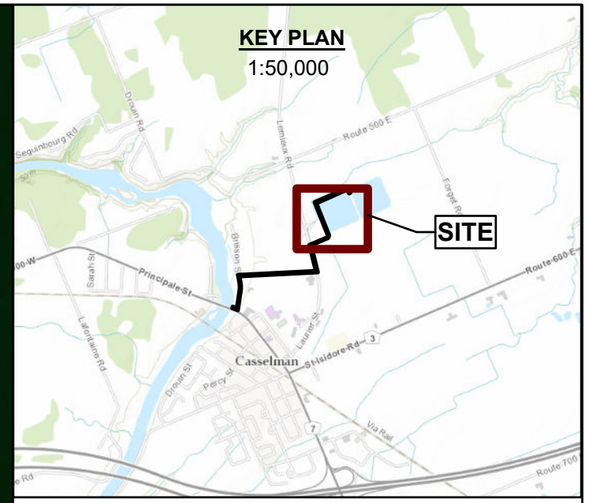

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

- BOREHOLE
- APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)
- PROJECT LIMIT

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N
2. Survey Reference based on PRS579626392983
   Easting: 476040.80m
   Northing: 5012925.07m
   Elevation: 78.42m
2. Geographic dataset source: Ontario GeoHub.
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4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:
1:2,000
Meters
0 27.5 55 110 165

Drawing
BOREHOLE LOCATION PLAN

Client:
J. L. RICHARDS & ASSOCIATES LIMITED

Project
CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	D.E.
Project No.	100117.051	Revision No.	0
Date	JANUARY 2025	**FIGURE A3**	

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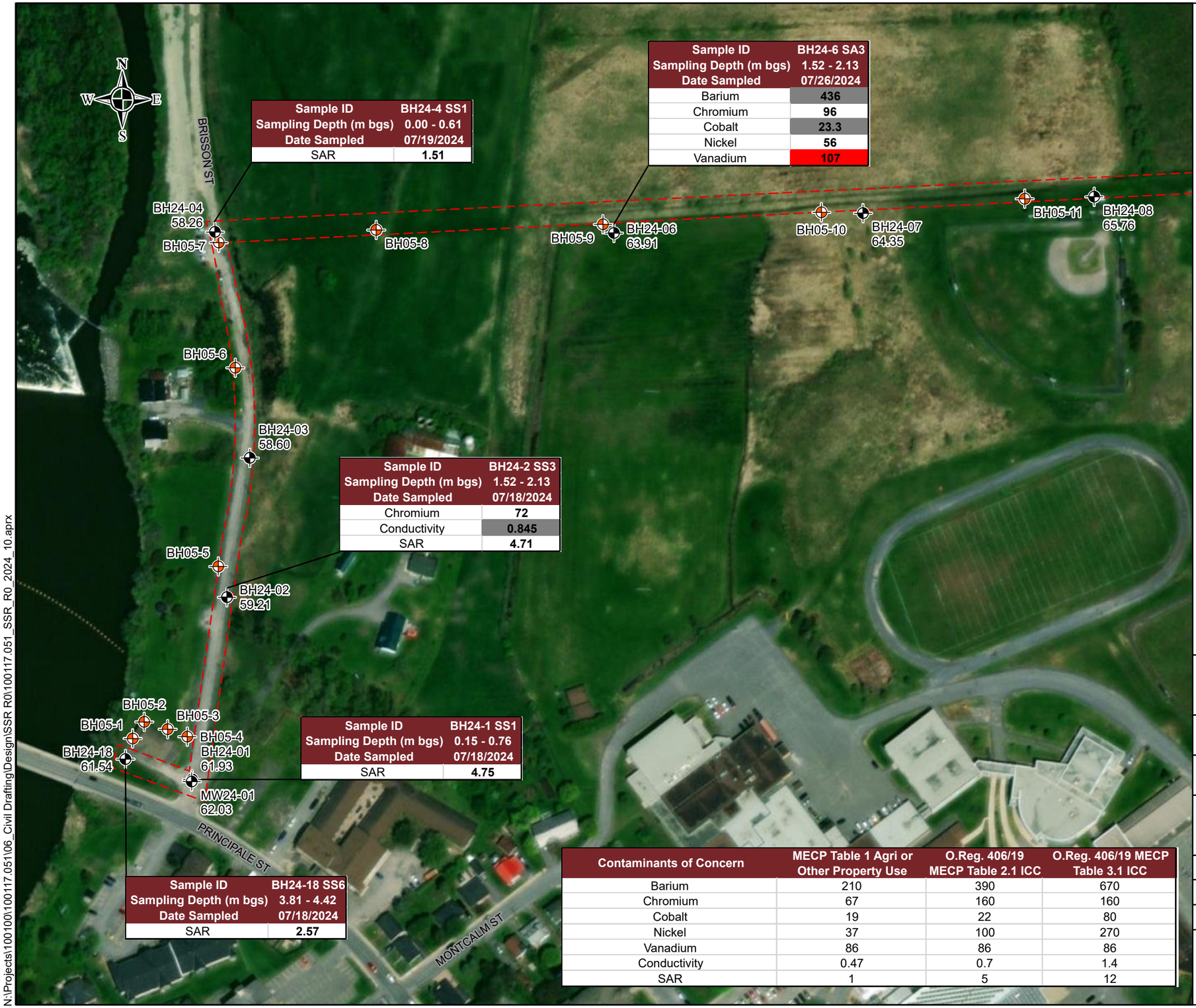

Sample ID	BH24-4 SS1
Sampling Depth (m bgs)	0.00 - 0.61
Date Sampled	07/19/2024
SAR	**1.51**

Sample ID	BH24-6 SA3
Sampling Depth (m bgs)	1.52 - 2.13
Date Sampled	07/26/2024
Barium	**436**
Chromium	**96**
Cobalt	**23.3**
Nickel	**56**
Vanadium	**107**

Sample ID	BH24-2 SS3
Sampling Depth (m bgs)	1.52 - 2.13
Date Sampled	07/18/2024
Chromium	**72**
Conductivity	**0.845**
SAR	**4.71**

Sample ID	BH24-1 SS1
Sampling Depth (m bgs)	0.15 - 0.76
Date Sampled	07/18/2024
SAR	**4.75**

Sample ID	BH24-18 SS6
Sampling Depth (m bgs)	3.81 - 4.42
Date Sampled	07/18/2024
SAR	**2.57**

Contaminants of Concern	MECP Table 1 Agri or Other Property Use	O.Reg. 406/19 MECP Table 2.1 ICC	O.Reg. 406/19 MECP Table 3.1 ICC
Barium	210	390	670
Chromium	67	160	160
Cobalt	19	22	80
Nickel	37	100	270
Vanadium	86	86	86
Conductivity	0.47	0.7	1.4
SAR	1	5	12

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE LOCATION

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

NOTES

RPI - Residential/Parkland/Institutional

ICC - Industrial/Commercial/Community

'm bgs' - Metres Below Ground Surface

MECP Table 1 Agri ESQS: Full Depth Background Site Condition Standards, Agriculture or Other Property Use.

MECP Table 2.1 Agri ESQS: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition, Agricultural or Other Property Use.

BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 3.1 ICC ESQS

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N

2. Survey Reference based on PRS579626392983
Easting: 476040.80m
Northing: 5012925.07m
Elevation: 78.42m

2. Geographic dataset source: Ontario GeoHub.

3. Contains information licensed under the Open Government Licence – Ontario.

4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:
1:2,000
Meters
0 27.5 55 110 165

Drawing
SOIL EXCEEDANCES

Client:
J. L. RICHARDS & ASSOCIATES LIMITED

Project
CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	D.E.
Project No.	100117.051	Revision No.	0
Date	JANUARY 2025		**FIGURE A4**

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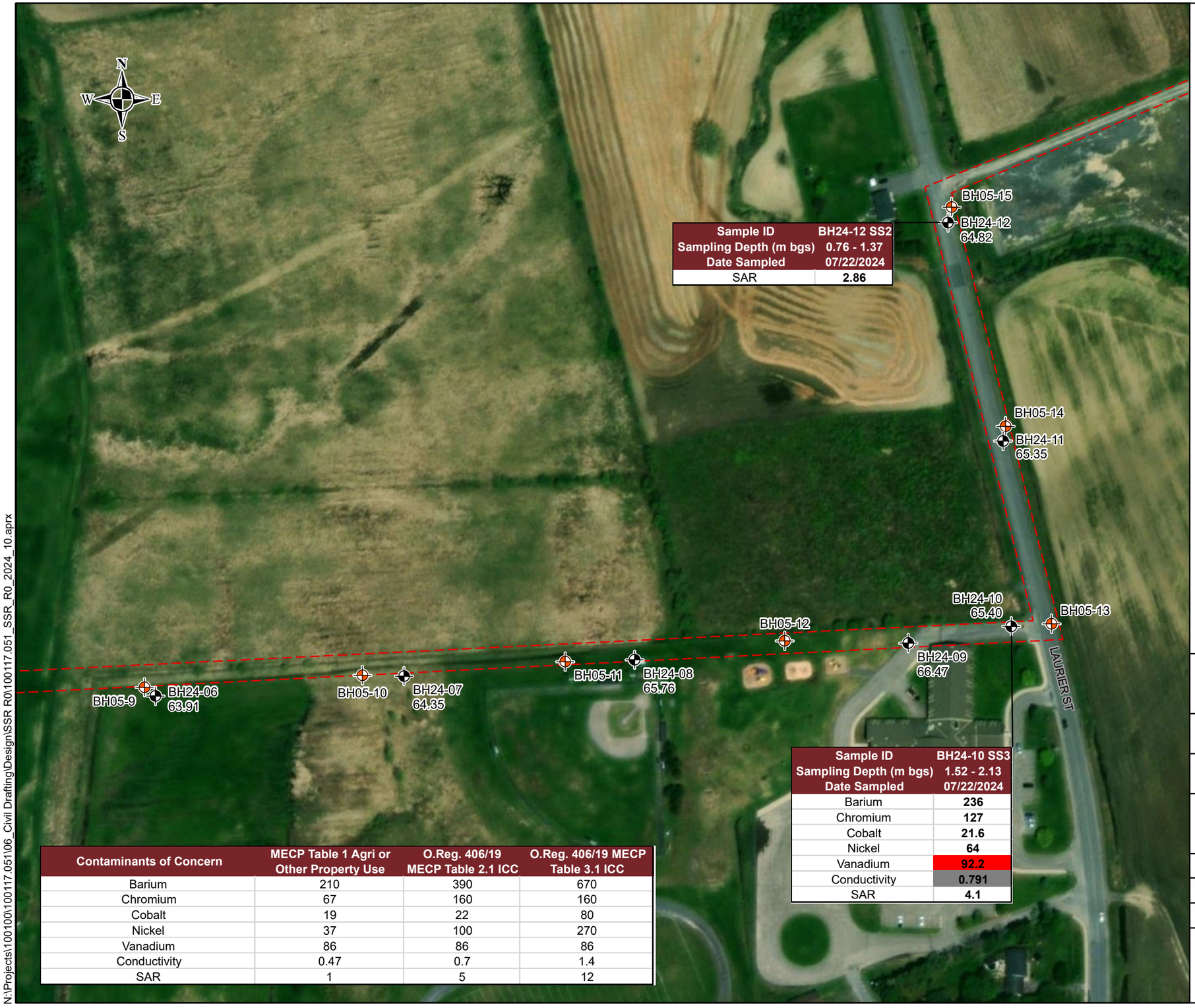

Sample ID	BH24-12 SS2
Sampling Depth (m bgs)	0.76 - 1.37
Date Sampled	07/22/2024
SAR	**2.86**

Sample ID	BH24-10 SS3
Sampling Depth (m bgs)	1.52 - 2.13
Date Sampled	07/22/2024
Barium	**236**
Chromium	**127**
Cobalt	**21.6**
Nickel	**64**
Vanadium	**92.2**
Conductivity	**0.791**
SAR	**4.1**

Contaminants of Concern	MECP Table 1 Agri or Other Property Use	O.Reg. 406/19 MECP Table 2.1 ICC	O.Reg. 406/19 MECP Table 3.1 ICC
Barium	210	390	670
Chromium	67	160	160
Cobalt	19	22	80
Nickel	37	100	270
Vanadium	86	86	86
Conductivity	0.47	0.7	1.4
SAR	1	5	12

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE LOCATION

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

NOTES

RPI - Residential/Parkland/Institutional

ICC - Industrial/Commercial/Community

'm bgs' - Metres Below Ground Surface

MECP Table 1 Agri ESQS: Full Depth Background Site Condition Standards, Agriculture or Other Property Use.

MECP Table 2.1 Agri ESQS: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition, Agricultural or Other Property Use.

BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 3.1 ICC ESQS

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N

2. Survey Reference based on PRS579626392983
Easting: 476040.80m
Northing: 5012925.07m
Elevation: 78.42m

2. Geographic dataset source: Ontario GeoHub.

3. Contains information licensed under the Open Government Licence – Ontario.

4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:

1:2,000 Meters

0 27.5 55 110 165

Drawing: SOIL EXCEEDANCES

Client: J. L. RICHARDS & ASSOCIATES LIMITED

Project: CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	D.E.
Project No.	100117.051	Revision No.	0
Date	JANUARY 2025	**FIGURE A5**	

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Sample ID	BH24-17 SS4
Sampling Depth (m bgs)	2.28 - 2.89
Date Sampled	07/22/2024
Chromium	**97**
Cobalt	**20.2**
Nickel	**51**
SAR	**1.1**

Contaminants of Concern	MECP Table 1 Agri or Other Property Use	O.Reg. 406/19 MECP Table 2.1 ICC	O.Reg. 406/19 MECP Table 3.1 ICC
Barium	210	390	670
Chromium	67	160	160
Cobalt	19	22	80
Nickel	37	100	270
Vanadium	86	86	86
Conductivity	0.47	0.7	1.4
SAR	1	5	12

LEGEND

BH # — BOREHOLE ID
XX.XX — GROUND SURFACE ELEVATIONS, IN METRES GEODETIC DATUM

BOREHOLE

APPROXIMATE BOREHOLE LOCATION (GOLDER, 2005)

PROJECT LIMIT

NOTES

RPI - Residential/Parkland/Institutional

ICC - Industrial/Commercial/Community

'm bgs' - Metres Below Ground Surface

MECP Table 1 Agri ESQS: Full Depth Background Site Condition Standards, Agriculture or Other Property Use.

MECP Table 2.1 Agri ESQS: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition, Agricultural or Other Property Use.

BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 3.1 ICC ESQS

GENERAL NOTES:

1. Coordinate system: NAD83(CSRS) / UTM zone 18N

2. Survey Reference based on PRS579626392983
Easting: 476040.80m
Northing: 5012925.07m
Elevation: 78.42m

2. Geographic dataset source: Ontario GeoHub.

3. Contains information licensed under the Open Government Licence – Ontario.

4. Service Layer Credits: World Topographic Map: Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, AAFC, NRCan, World Imagery: SDG Counties, Maxar, Microsoft

Scale:
1:2,000
Meters
0 27.5 55 110 165

Drawing
SOIL EXCEEDANCES

Client:
J. L. RICHARDS & ASSOCIATES LIMITED

Project
CASSELMAN MAIN SEWAGE PUMPING STATION (SPS) UPGRADES
CASSELMAN, ONTARIO

Drwn By:	S.L.	Chkd By:	D.E.
Project No.	100117.051	Revision No.	0
Date	JANUARY 2025		**FIGURE A6**

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APPENDIX B

Borehole Logs

RECORD OF BOREHOLE 24-1

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		61.93									
0	Power Auger Hollow Stem Auger (210mm OD)	28mm ASPHALTIC CONCRETE		0.03									Asphaltic coldpatch repair
		Grey, crushed sand and gravel, trace silt (BASE/SUBBASE MATERIAL)		61.51							None		
		Stiff to very stiff, red grey brown SILTY CLAY		0.42	1	SS	250	16	M&Is, PAHs, PHC F1-F4/BTEX	Hex: 0; IBL: 0	None		
											None		
1					2	SS	400	9		Hex: 0; IBL: 1	None		
				60.41									
		Very stiff, grey brown SILTY CLAY, trace sand		1.52	3	SS	500	14		Hex: 0; IBL: 2	None		Backfilled with auger cuttings
2					4	SS	350	14		Hex: 0; IBL: 1	None		
				58.88									
3		Dense to very dense, brown silty sand, trace clay and gravel (GLACIAL TILL)		3.05	5	SS	350	34		Hex: 50; IBL: 2	None		
				58.12									
		End of Borehole Auger refusal		3.81									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-2

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		59.21									
0	Power Auger Hollow Stem Auger (210mm OD)	Grey, crushed sand and gravel, trace silt (ROADWAY MATERIAL)											Asphaltic coldpatch
				0.20									
		Brown silty sand and gravel, trace clay (FILL MATERIAL)			1	SS	300	26		Hex: 0; IBL: 2	None		
1					2	SS	200	16		Hex: 0; IBL: 2	None		Backfilled with auger cuttings
				57.99									
		Stiff to very stiff, grey brown SILTY CLAY		1.22									
					3	SS	450	7	M&Is, PHC F1-F4/BTEX	Hex: 0; IBL: 2	None		
2				56.92									
		Grey silty sand and gravel, trace clay (GLACIAL TILL)		2.29	4	SS	75	50 for 75mm		Hex: 0; IBL: 1	None		
				56.67									
	Diamond Rotary Core HQ (89mm OD)	BEDROCK		2.54	5	RC		TCR= 77%, SCR=77%, RQD= 77%					
3													Bentonite seal
					6	RC		TCR= 94%, SCR=89%, RQD= 79%					
4				54.81									
		End of Borehole		4.40									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-3

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 19 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		58.60									
0	Power Auger / Hollow Stem Auger (210mm OD)	Grey, crushed sand and gravel (ROADWAY MATERIAL)		0.20									Asphaltic coldpatch repair
		Grey gravel, some sand (FILL MATERIAL)											Backfilled with auger cuttings
1		Stiff to very stiff, grey brown SILTY CLAY		57.42 1.18									
		End of Probe Hole Auger Refusal		56.75 1.85									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-4

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 19 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		58.26									
0	Power Auger / Hollow Stem Auger (210mm OD)	Grey, crushed sand and gravel (ROADWAY MATERIAL)			1	SS		41	M&Is, PAHs, PHC F1-F4/BTEX	Hex: NA; IBL: NA	None		Flush Mount Casing and sand
				57.60									
1	Diamond Rotary Core HQ (89mm OD)	BEDROCK		0.66	2	RC		TCR= 89%, SCR= 68%, RQD= 48%					Bentonite Seal
2					3	RC		TCR= 93%, SCR= 91%, RQD= 91%					
3					4	RC		TCR= 99%, SCR= 99, RQD= 92%					Filter Sand
4					5	RC		TCR= 100%, SCR= 89%, RQD= 89%					50mm diameter, 1.5m long PVC screen
				53.38									
		End of Borehole		4.88									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 07/24	0.94 ▽	57.32

GEMTEC
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LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-6

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 25 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		63.91									
		TOPSOIL		0.03									Asphaltic coldpatch repair
		Stiff to very stiff, grey brown SILTY CLAY			1	SS	450	3		Hex: 0; IBL: 18	None		
1					2	SS	500	12		Hex: 0; IBL: 25	None		
2					3	SS	610	10	M&Is, PAHs, PHC F1-F4/BTEX	Hex: 0; IBL: 27	None		Backfilled with auger cuttings
				61.32	4	SS	425	21		Hex: 0; IBL: 12	None		
3		Compact to very dense, grey brown gravelly silty sand, some clay, possible cobbles and boulders (GLACIAL TILL)		2.59	5	SS	125	50 for 75mm		Hex: 0; IBL: 9	None		
4					6	SS	350	28		Hex: 0; IBL: 30	None		
				59.49									
		End of borehole		4.42									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-7

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 25 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		64.35									
0	Power Auger / Hollow Stem Auger (210mm OD)	Probe Hole - Soil not sampled											Asphaltic coldpatch repair
1													
2													Backfilled with auger cuttings
3													
4				59.77									
		End of Probe Hole		4.58									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-8

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 25 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		65.76									
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL Grey brown silty clay, trace sand (FILL MATERIAL)		0.05	1	SS	350	2		Hex: 0; IBL: 21	None		Asphaltic coldpatch repair
1		FORMER TOPSOIL LAYER Stiff to very stiff, grey brown SILTY CLAY		64.69 1.07 1.10	2	SS	400	3		Hex: 0; IBL: 11	None		
2					3	SS	610	8		Hex: 0; IBL: 13	None		Backfilled with auger cuttings
					4	SS	610	9		Hex: 0; IBL: 19	None		
3		Compact to very dense, grey brown silty sand, some clay and gravel, possible cobbles and boulders (GLACIAL TILL)		63.01 2.75	5	SS	400	32	M&Is, PHC F1-F4/BTEX	Hex: 0; IBL: 12	None		
4					6	SS	450	52		Hex: 0; IBL: 19	None		
		End of borehole		61.34 4.42									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-9

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		66.47									
0	Power Auger / Hollow Stem Auger (210mm OD)	Probe Hole - Soil not sampled											Asphaltic coldpatch repair
1													
2													Backfilled with auger cuttings
3													
4				61.89									
		End of Probe Hole		4.58									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-10

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		65.40									
		100mm ASPHALTIC CONCRETE		0.10									
		Grey crushed sand and gravel, trace silt (BASE MATERIAL)		65.07	1	SS	250	10		Hex: 0; IBL: 90	None		Flushmount Casing and Bentonite
		Grey crushed sand and gravel, trace silt (SUBBASE MATERIAL)		0.33 64.75									
		Stiff to very stiff, red grey brown SILTY CLAY, trace sand		0.65									
1					2	SS	200	5		Hex: 0; IBL: 0	None		Auger Cuttings
					3	SS	610	4	M&Is, PHC F1-F4/BTEX	Hex: 30; IBL: 100	None		Bentonite Seal
2													
		Compact, grey brown silty sand and gravel, some clay, possible cobbles and boulders (GLACIAL TILL)		62.96 2.44	4	SS	350	20		Hex: 25; IBL: 75	None		Filter Sand
3				62.35									
		Compact, grey gravelly silty sand, trace clay, possible cobbles and boulders (GLACIAL TILL)		3.05	5	SS	250	23		Hex: 60; IBL: 88	None		50mm diameter, 3.05m long PVC screen
4					6	SS	300	20		Hex: 10; IBL: 100	None		Filter Sand
				60.98									
		End of Borehole		4.42									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 07/24	0.99 ▽	64.41

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LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-11

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		65.35									
0	Power Auger Hollow Stem Auger (210mm OD)	Probe Hole - Soil not sampled											Asphaltic coldpatch repair
1													
2													
3													Backfilled with auger cuttings
4													
5				60.16									
		End of Probe Hole		5.19									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-12

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		64.82									
0	Power Auger Hollow Stem Auger (210mm OD)	60mm ASPHALTIC CONCRETE		0.06									Asphaltic coldpatch repair
		Grey, crushed sand and gravel, trace silt (BASE MATERIAL)		64.59 0.23									
		Brown sand and gravel, trace to some silt (SUBBASE MATERIAL)		64.37 0.45	1	SS	375	42		Hex: 15; IBL: 58	None		
1		Light brown silty sand (FILL MATERIAL)		63.60	2	SS	375	12	M&Is, PAHs, PHC F1-F4/BTEX	Hex: 10; IBL: 74	None		
		FORMER TOPSOIL LAYER		1.22 63.45									
		Stiff to very stiff, red grey brown SILTY CLAY		1.37	3	SS	450	15		Hex: 5; IBL: 55	None		
2					4	SS	450	11		Hex: 20; IBL: 56	None		Backfilled with auger cuttings
				62.07									
		Loose to compact, grey brown silty sand and gravel, some clay, possible cobbles and boulers (GLACIAL TILL)		2.75									
3					5	SS	400	19		Hex: 39; IBL: 70	None		
				61.46									
		Loose to compact, grey silty sand and gravel, some clay, possible cobbles and boulers (GLACIAL TILL)		3.36									
4					6	SS	150	6		Hex: 0; IBL: 90	None		
				60.25									
		Loose, grey coarse SAND, some gravel		4.57	7	SS	400	8		Hex: 50; IBL: 65	None		
5				59.63									
		End of borehole		5.19									

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LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-14

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 26 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		67.69									
0	Power Auger / Hollow Stem Auger (210mm OD)	Probe Hole - Not Sampled											Asphaltic coldpatch repair
1													
2													Backfilled with auger cuttings
3													
4													
		End of borehole		63.11 4.58									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-15

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 26 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		67.77									
0	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		0.03	1	SS	400	10		Hex: 0; IBL: 30	None		
		Grey brown silt and sand, some clay, trace gravel and organice material (FILL MATERIAL)			2	SS	350	10		Hex: 30; IBL: 45	None		
1					3	SS	450	11	M&Is, PAHs, PHC F1-F4/BTEX	Hex: 50; IBL: 53	None		
2					4	SS	450	6		Hex: 30; IBL: 30	None		Backfilled with auger cuttings
3				64.72									
		Compact, grey SANDY SILT		3.05	5	SS	450	21		Hex: 90; IBL: 11	None		
				63.96									
4		Stiff to very stif, grey brown SILTY CLAY		3.81	6	SS	610	2		Hex: 20; IBL: 8	None		
				63.35									
		End of borehole		4.42									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

RECORD OF BOREHOLE 24-16

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 26 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		67.58									
0	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		0.05	1	SS	250	3		Hex: 25; IBL: 2	None		Flush mount protective cover
		Grey brown silty sand, some clay, trace gravel and organice material (FILL MATERIAL)			2	SS	350	6		Hex: 15; IBL: 4	None		
1					3	SS	350	4	M&Is, PAHs, PHC F1-F4/VOCs	Hex: 15; IBL: 6	None		
2					4	SS	500	8		Hex: 30; IBL: 15	None		Auger cuttings
3					5	SS	400	3		Hex: 15; IBL: 3	None		
4					6	SS	500	3		Hex: 15; IBL: 6	None		Bentonite Seal
					7	SS	500	6		Hex: 75; IBL: 7	None		Filter sand
5				62.39									
		Stiff to very stiff, red grey brown SILTY CLAY		5.19	8	SS	610	6		Hex: 35; IBL: 2	None		50mm diameter, 1.5m long PVC screen
6				61.48									
		Stiff to very stiff, grey brown SILTY CLAY		6.10	9	SS	610	2		Hex: 40; IBL: 2	None		
				60.87									
		End of borehole		6.71									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 07/24	1.09 ▽	66.49

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE 24-17

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 22 2024

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		67.69									
0	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		0.05									Asphaltic coldpatch repair
		Brown sand, some silt and clay, trace gravel, trace organic material (FILL MATERIAL)			1	SS	350	14		Hex: 30; IBL: 90	None		
1					2	SS	400	8		Hex: 40; IBL: 60	None		
				65.86	3	SS	400	6		Hex: 35; IBL: 90	None		
2		Stiff to very stiff, red grey brown SILTY CLAY, trace sand		1.83									Backfilled with auger cuttings
					4	SS	450	7	M&Is, PHC F1-F4/BTEX	Hex: 10; IBL: 70	None		
3					5	SS	100	2		Hex: 20; IBL: 45	None		
4					6	SS	610	4		Hex: 20; IBL: 65	None		
				63.27									
		End of borehole		4.42									

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

RECORD OF BOREHOLE 24-18

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	TYPE	RECOVERY (mm)	BLOWS/0.3m	LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
		Ground Surface		61.54									
0	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		0.08									Above Ground Protective Casing and Bentonite
		Brown sandy clayey silt, trace gravel, trace boulders (FILL MATERIAL)			1	SS	350	8		Hex: 0; IBL: 1	None		
1					2	SS	225	51 for 200mm		Hex: 15; IBL: 1	None		
2					3	SS	250	53 for 250mm		Hex: 15; IBL: 1	None		Auger Cuttings
					4	SS	125	5		Hex: 15; IBL: 4	None		
3					5	SS	250	4		Hex: 20; IBL: 2	None		
4					6	SS	400	2	M&Is, PHC F1-F4/BTEX	Hex: 15; IBL: 3	None		
				56.91									
		BEDROCK		4.63	7	SS	50	50 for 125mm		Hex: 0; IBL: 1	None		
5					8	RC		TCR= 94%, SCR=75%, RQD= 53%					Bentonite Seal
6					9	RC		TCR= 100%, SCR=71%, RQD= 60%					Filter Sand
7													50mm diameter, 1.5m long PVC SCREEN
8					10	RC		TCR= 98%, SCR=89%, RQD= 85%					
				52.75									
		End of borehole		8.79									

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 07/24	4.85 ▽	56.69

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051 BH_LOGS 2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

RECORD OF BOREHOLE MW24-1

CLIENT: J.L. Richards & Associates Limited
PROJECT: Casselman Main Sewage Pumping Station (SPS) Upgrades
JOB#: 100117.051
LOCATION: See Figures A.1 to A.3, Appendix A

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jul 18 2024

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLE DATA: NUMBER	SAMPLE DATA: TYPE	SAMPLE DATA: RECOVERY (mm)	SAMPLE DATA: BLOWS/0.3m	SAMPLE DATA: LABORATORY ANALYSES	COMBUSTIBLE VAPOUR CONCENTRATION (ppm)	ODOUR	TPH (mg/kg)	MONITORING WELL INSTALLATION AND NOTES
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		62.03									
0		Borehole not sampled											Flush Mount Casing and sand
1													Auger Cuttings
2													Bentonite Seal
2													Filter Sand
3				58.04 / 3.99									50mm diameter, 1.5m long PVC screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEVATION (m)
Aug. 07/24	2.42 ▽	59.61

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Consulting Engineers and Scientists

LOGGED: ML
CHECKED: LB/DE

ENV - BOREHOLE LOG 100117.051_BH_LOGS_2024-07-25.GPJ GEMTEC 2018.GDT 10/1/24

APPENDIX C

Soil Analytical Results

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Table C.1: Summary of Soil Analytical Results
Metals, Inorganics, and Polycyclic Aromatic Hydrocarbons
Casselman Main Sewage Pumping Station (SPS) Upgrades
Casselman, Ontario

Contaminants of Concern	O.Reg. 406/19 MECP Table 1 Agri or Other Property Uses	O.Reg. 406/19 MECP Table 2.1 RPI	O.Reg. 406/19 MECP Table 3.1 ICC	Reporting Detection Limit	Sample ID	BH24-1 SS1	BH24-2 SS3	BH24-4 SS1	BH24-6 SA3	BH24-8 SA5	BH24-10 SS3	BH24-12 SS2	BH24-15 SA3	BH24-16 SS3	BH24-17 SS4	BH24-18 SS6
					Sample Depth (m bgs)	0.15 - 0.76	1.52 - 2.13	0.00 - 0.61	1.52 - 2.13	3.04 - 3.65	1.52 - 2.13	0.76 - 1.37	1.52 - 2.13	1.52 - 2.13	2.28 - 2.89	3.81 - 4.42
					Lab ID	6024428	6024430	6024431	6032861	6032884	6024432	6024433	6032885	6032886	6024434	6024435
					Sampling Date	07/18/2024	07/18/2024	07/19/2024	07/26/2024	07/26/2024	07/22/2024	07/22/2024	07/26/2024	07/26/2024	07/22/2024	07/18/2024
					Units											
Metals and Inorganics - Soil																
Antimony	1	7.5	40	0.8	µg/g	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	11	18	18	1	µg/g	1	2	2	2	4	2	1	2	1	2	1
Barium	210	390	670	2	µg/g	28.3	164	79.9	**436**	43.1	**236**	23.4	107	73.7	143	55.5
Beryllium	2.5	4	8	0.5	µg/g	<0.5	1	<0.5	1	<0.5	1.2	<0.5	0.6	<0.5	1	<0.5
Boron	36	120	120	5	µg/g	<5	7	9	10	6	13	<5	7	5	10	<5
Boron, available	NS	1.5	2	0.1	µg/g	0.11	<0.10	0.31	0.11	<0.10	0.11	<0.10	<0.10	0.13	0.1	0.27
Cadmium	1	1.2	1.9	0.5	µg/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	67	160	160	5	µg/g	7	**72**	16	**96**	11	**127**	10	65	45	**97**	30
Cobalt	19	22	80	0.8	µg/g	2.4	15.5	4.7	**23.3**	4.9	**21.6**	4.2	11	7.9	**20.2**	5.8
Copper	62	140	230	1	µg/g	4.6	16.6	10.4	45.6	17.2	46.2	13.7	24.3	15.3	36.3	12.3
Lead	45	120	120	1	µg/g	10	8	7	9	3	11	2	6	5	9	16
Molybdenum	2	6.9	40	0.5	µg/g	0.6	<0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	37	100	270	1	µg/g	1	33	7	**56**	8	**64**	7	33	22	**51**	15
Selenium	1.2	2.4	5.5	0.8	µg/g	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Silver	0.5	20	40	0.5	µg/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	1	1	3.3	0.5	µg/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Uranium	1.9	23	33	0.5	µg/g	<0.50	0.96	<0.50	0.67	0.58	0.81	0.74	0.83	0.73	0.7	0.64
Vanadium	86	86	86	2	µg/g	6.2	65	16.6	**107**	18.9	**92.2**	18.9	52.3	36	77	26.9
Zinc	290	340	340	5	µg/g	11	90	25	131	32	106	22	50	37	75	46
Chromium (VI)	0.66	8	8	0.2	µg/g	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, free	0.051	0.051	0.051	0.04	µg/g	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	0.16	0.27	0.27	0.1	µg/g	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Conductivity	0.47	0.7	1.4	0.005	mS/cm	0.31	**0.845**	0.202	0.065	0.099	**0.791**	0.172	0.16	0.126	0.195	0.286
SAR	1	5	12	-	N/A	**4.75**	**4.71**	**1.51**	0.459	0.274	**4.1**	**2.86**	0.301	0.366	**1.1**	**2.57**
pH	Surface Soil: 5-9 Subsurface Soil: 5-11	Surface Soil: 5-9 Subsurface Soil: 5-11	Surface Soil: 5-9 Subsurface Soil: 5-11	-	pH Units	6.72	6.63	6.67	6.77	6.82	6.73	6.71	6.9	6.67	6.7	6.68
Polycyclic Aromatic Hydrocarbons - Soil																
Naphthalene	0.05	0.2	1.8	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Acenaphthylene	0.093	0.093	0.093	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Acenaphthene	0.05	2.5	15	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Fluorene	0.05	6.8	6.8	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Phenanthrene	0.19	6.2	12	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Anthracene	0.05	0.16	0.16	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Fluoranthene	0.24	0.69	70	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Pyrene	0.19	28	70	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Benzo[a]anthracene	0.095	0.5	1	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Chrysene	0.18	7	14	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Benzo[b]fluoranthene	0.3	3.2	7	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Benzo[k]fluoranthene	0.05	3.1	7	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Benzo[a]pyrene	0.05	0.31	0.7	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Indeno [1,2,3-cd] pyrene	0.11	0.38	0.76	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Dibenzo[a,h]anthracene	0.1	0.57	0.7	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
Benzo[g,h,i]perylene	0.2	6.6	13	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA
1,2-Methylnaphthalene	0.05	0.59	8.7	0.05	µg/g	<0.05	NA	<0.05	<0.05	NA	NA	<0.05	<0.05	<0.05	NA	NA

Notes:
RPI - Residential/Parkland/Institutional
ICC - Industrial/Commercial/Community
m bgs' - Metres Below Ground Surface
'NA' - Not Analyzed
<' - Non-Detect Sample

MECP Table 1 Agri ESQS: Full Depth Background Site Condition Standards, Agriculture or Other Property Use.

MECP Table 2.1 Agri ESQS: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition, Agricultural or Other Property Use.

MECP Table 3.1 ICC ESQS: Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition, ICC Property Use.

BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 2.1 RPI ESQS
BOLD	- Exceeds MECP Table 3.1 ICC ESQS

Client: J.L. Richards & Associates Limited
Project Number: 100117.051
September 2024

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Table C.2: Summary of Soil Analytical Results
Petroleum Hydrocarbon F1-F4 and Volatile Organic Compounds
Casselman Main Sewage Pumping Station (SPS) Upgrades
Casselman, Ontario

Contaminants of Concern	O.Reg. 406/19 MECP Table 1 Agri or Other Property Uses	O.Reg. 406/19 MECP Table 2.1 RPI	O.Reg. 406/19 MECP Table 3.1 ICC	Reporting Limit or Method Detection Limit	Sample ID	BH24-1 SS1	BH24-2 SS3	BH24-4 SS1	BH24-6 SA3	BH24-8 SA5	BH24-10 SS3	BH24-12 SS2	BH24-15 SA3	BH24-16 SS3	BH24-17 SS4	BH24-18 SS6
					Sample Depth (m bgs)	0.15 - 0.76	1.52 - 2.13	0.00 - 0.61	1.52 - 2.13	3.04 - 3.65	1.52 - 2.13	0.76 - 1.37	1.52 - 2.13	1.52 - 2.13	2.28 - 2.89	3.81 - 4.42
					Lab ID	6024428	6024430	6024431	6032861	6032884	6024432	6024433	6032885	6032886	6024434	6024435
					Sampling Date	07/18/2024	07/18/2024	07/19/2024	07/26/2024	07/26/2024	07/22/2024	07/22/2024	07/26/2024	07/26/2024	07/22/2024	07/18/2024
					Units											
Petroleum Hydrocarbons - Soil																
F1 PHCs (C6-C10)	17	25	25	5	µg/g	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
F1 PHCs (C6-C10) minus BTEX	NS	NS	NS	5	µg/g	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
F2 PHCs (C10-C16)	10	10	26	10	µg/g	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
F3 PHCs (C16-C34)	240	240	1700	50	µg/g	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
F4 PHCs (C34-C50)	120	2800	3300	50	µg/g	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Volatile Organic Compounds - Soil																
Benzene	0.02	0.02	0.034	0.02	µg/g	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Toluene	0.2	0.2	7.8	0.05	µg/g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ethylbenzene	0.05	0.05	1.9	0.05	µg/g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
m/p-Xylene	NS	NS	NS	0.05	µg/g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
o-Xylene	NS	NS	NS	0.05	µg/g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Xylenes, total	0.05	0.091	3	0.05	µg/g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dichlorodifluoromethane	0.05	1.5	1.8	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Vinyl Chloride	0.02	0.02	0.02	0.02	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.02	NA	NA
Bromomethane	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Trichlorofluoromethane	0.05	0.25	0.46	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Acetone	0.5	0.5	1.8	0.5	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.50	NA	NA
1,1-Dichloroethylene	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Methylene Chloride	0.05	0.05	0.2	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
trans-1,2-Dichloroethylene	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Methyl tert-butyl Ether	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1-Dichloroethane	0.05	0.05	0.57	0.02	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.02	NA	NA
Methyl Ethyl Ketone	0.5	0.5	26	0.5	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.50	NA	NA
cis-1,2-Dichloroethylene	0.05	0.05	0.05	0.02	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.02	NA	NA
Chloroform	0.05	0.05	0.26	0.04	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.04	NA	NA
1,2-Dichloroethane	0.05	0.05	0.05	0.03	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.03	NA	NA
1,1,1-Trichloroethane	0.05	0.11	0.4	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Carbon Tetrachloride	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,2-Dichloropropane	0.05	0.05	0.05	0.03	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.03	NA	NA
Trichloroethylene	0.05	0.05	0.05	0.03	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.03	NA	NA
Bromodichloromethane	0.05	0.05	5.8	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Methyl Isobutyl Ketone	0.5	0.5	17	0.5	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.50	NA	NA
1,1,2-Trichloroethane	0.05	0.05	0.05	0.04	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.04	NA	NA
Dibromochloromethane	0.05	0.05	5.5	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Ethylene Dibromide	0.05	0.05	0.05	0.04	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.04	NA	NA
Tetrachloroethylene	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1,1,2-Tetrachloroethane	0.05	0.05	0.05	0.04	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.04	NA	NA
Chlorobenzene	0.05	0.083	0.28	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Bromoform	0.05	0.05	2.5	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Styrene	0.05	0.05	6.8	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,1,2,2-Tetrachloroethane	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,3-Dichlorobenzene	0.05	0.26	6.8	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,4-Dichlorobenzene	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,2-Dichlorobenzene	0.05	3.4	6.8	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
1,3-Dichloropropene, total	0.05	0.05	0.05	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA
Hexane	0.05	2.5	2.5	0.05	µg/g	NA	NA	NA	NA	NA	NA	NA	NA	<0.05	NA	NA

Notes:
RPI - Residential/Parkland/Institutional
ICC - Industrial/Commercial/Community
m bgs' - Metres Below Ground Surface
'NS' - No Standard
'NA' - Not Analyzed
<' - Non-Detect Sample

MECP Table 1 Agri ESQS: Full Depth Background Site Condition Standards, Agriculture or Other Property Use.

MECP Table 2.1 RPI ESQS: Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition, RPI Property Use.

MECP Table 3.1 ICC ESQS: Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition, ICC Property Use.

BOLD	- Exceeds MECP Table 1 Agri ESQS
BOLD	- Exceeds MECP Table 2.1 RPI ESQS
BOLD	- Exceeds MECP Table 3.1 ICC ESQS

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Table C.3: Summary of Soil Analytical Results
modified Synthetic Precipitation Leaching Procedure
Metals
Casselman Main Sewage Pumping Station (SPS) Upgrades
Casselman, Ontario

Contaminants of Concern	Table 1: Leachate Screening Levels Agri or Other Property Use	Table 2.1: Leachate Screening Levels RPI	Table 3.1: Leachate Screening Levels ICC	Reporting Detection Limit	Sample ID Sample Depth Lab ID Sampling Date Units	BH24-2 SS3 1.52 - 2.13 6024430 07/18/2024	BH24-6 SA3 1.52 - 2.13 6032861 07/26/2024	BH24-10 SS3 1.52 - 2.13 6024432 07/22/2024	BH24-17 SS4 2.28 - 2.89 6024434 07/22/2024
SPLP - Metals									
Antimony	6	6	NS	0.6	µg/L	<0.6	<0.6	<0.6	<0.6
Arsenic	NS	NS	NS	5	µg/L	<5	<5	<5	<5
Barium	NS	1000	4600	100	µg/L	<100	<100	<100	<100
Beryllium	NS	4	11	0.8	µg/L	<0.8	<0.8	<0.8	<0.8
Boron (total)	NS	5000	NS	500	µg/L	<500	<500	<500	<500
Cadmium	NS	NS	0.5	0.2	µg/L	<0.20	<0.20	<0.20	<0.20
Chromium Total	NS	50	130	10	µg/L	<10	<10	<10	<10
Cobalt	NS	3.8	10	0.3	µg/L	0.4	<0.3	<0.3	<0.3
Copper	NS	14	14	6.9	µg/L	<6.9	<6.9	<6.9	<6.9
Lead	NS	NS	NS	1	µg/L	<1.0	<1.0	<1.0	<1.0
Molybdenum	23	23	1500	1.5	µg/L	<1.5	<1.5	<1.5	<1.5
Nickel	NS	78	78	10	µg/L	<10	<10	<10	<10
Selenium	NS	10	10	5	µg/L	<5.0	<5.0	<5.0	<5.0
Silver	0.3	0.3	0.3	0.1	µg/L	<0.10	<0.10	<0.10	<0.10
Thallium	2	2	80	0.5	µg/L	<0.5	<0.5	<0.5	<0.5
Uranium	NS	20	66	2	µg/L	<2	<2	<2	<2
Vanadium	NS	NS	NS	0.6	µg/L	5.4	7.5	8.5	1.5
Zinc	NS	180	180	20	µg/L	<20	<20	<20	<20

Notes:
mb gs' - Metres Below Ground Surface
'NS' - No Standard
<' - Non-Detect Sample

MECP Table 1 ESQS (O.Reg. 406/19): Rules for Soil Management and Excess Soil Quality Standards. Table 1: Leachate Screening Levels for Excess Soil Reuse, Agriculture or Other Property Use.

MECP Table 2.1 ESQS (O.Reg. 406/19): Rules for Soil Management and Excess Soil Quality Standards. Table 2.1: Leachate Screening Levels for Full Depth Excess Soil in a Potable Ground Water Condition, RPI Property Use.

MECP Table 3.1 ESQS (O.Reg. 406/19): Rules for Soil Management and Excess Soil Quality Standards. Table 3.1: Leachate Screening Levels for Full Depth Excess Soil in a Non-Potable Ground Water Condition, ICC Property Use.

BOLD	- Exceeds MECP Table 1 RPI/ICC SCS
BOLD	- Exceeds MECP Table 9 RPI/ICC SCS
BOLD	- Exceeds MECP Table 2.1 RPI ESQS

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Table C.4: Summary of Soil Analytical Results
Toxicity Characteristic Leaching Procedure
Casselman Main Sewage Pumping Station (SPS) Upgrades
Casselman, Ontario

Contaminants of Concern	O.Reg. 347/558 Schedule 4	Reporting Detection Limit	Sample ID Lab ID Sampling Date Units	TCLP 6071900 07/31/2024
Physical Characteristics				
Flashpoint	NS	-	Deg C	>100
EPA 1311 - TCLP Leachate Inorganics				
Fluoride	150	0.1	mg/L	0.16
Cyanide, free	20	0.05	mg/L	<0.05
Nitrate + Nitrite (as Nitrogen)	1000	0.7	mg/L	<0.70
EPA 1311 - TCLP Leachate Metals				
Arsenic	2.5	0.01	mg/L	<0.010
Barium	100	0.02	mg/L	0.682
Boron	500	0.05	mg/L	<0.050
Cadmium	0.5	0.01	mg/L	<0.010
Chromium	5	0.05	mg/L	<0.050
Lead	5	0.01	mg/L	0.015
Mercury	0.1	0.01	mg/L	<0.01
Selenium	1	0.02	mg/L	<0.020
Silver	5	0.01	mg/L	<0.010
Arsenic	2.5	0.05	mg/L	<0.050
EPA 1311 - TCLP Leachate Volatiles				
Benzene	0.5	0.02	mg/L	<0.020
Carbon Tetrachloride	0.5	0.02	mg/L	<0.020
Chlorobenzene	8	0.01	mg/L	<0.010
Chloroform	10	0.02	mg/L	<0.020
1,2-Dichlorobenzene	20	0.01	mg/L	<0.010
1,4-Dichlorobenzene	0.5	0.01	mg/L	<0.010
1,2-Dichloroethane	0.5	0.02	mg/L	<0.020
1,1-Dichloroethylene	1.4	0.02	mg/L	<0.020
Methyl Ethyl Ketone (2-Butanone)	200	0.09	mg/L	<0.090
Methylene Chloride	5	0.03	mg/L	<0.030
Tetrachloroethylene	3	0.05	mg/L	<0.050
Trichloroethylene	5	0.02	mg/L	<0.020
Vinyl Chloride	0.2	0.03	mg/L	<0.030
EPA 1311 - TCLP Leachate Organics				
Benzo[a]pyrene	0.001	0.001	mg/L	<0.001

Notes:
NS ' : No Standard Established
ND ' : Non Detect
1. O.Reg. 347/558 Schedule 4: O.Reg 347 and O. Reg. 558/00: General – Waste Management. Schedule 4: Leachate Quality Criteria. (MECP, 2011)
Bold Exceeds O.Reg 347/558 Schedule 4

APPENDIX D

Laboratory Certificate of Analysis

Report to: J.L. Richards & Associates Limited
GEMTEC Project: 100117.051 (January 13, 2025)

AGAT Laboratories

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CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
32 STEACIE DRIVE
OTTAWA, ON K2K 2A9
(613) 836-1422

ATTENTION TO: Mohit Bhargav

PROJECT: 100117.051

AGAT WORK ORDER: 24Z176894

SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead

TRACE ORGANICS REVIEWED BY: Radhika Chakraberty, Trace Organics Lab Manager

DATE REPORTED: Aug 08, 2024

PAGES (INCLUDING COVER): 18

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.
- This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.

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Certificate of Analysis

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2024-07-23

DATE REPORTED: 2024-08-08

		SAMPLE DESCRIPTION:		BH24-1 SS1	BH24-2 SS3	BH24-4 SS1	BH24-10 SS3	BH24-12 SS2	BH24-17 SS4	BH24-18 SS6
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2024-07-18	2024-07-18	2024-07-19	2024-07-22	2024-07-22	2024-07-22	2024-07-18
Parameter	Unit	G / S	RDL	6024428	6024430	6024431	6024432	6024433	6024434	6024435
Antimony	µg/g		0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g		1	1	2	2	2	1	2	1
Barium	µg/g		2.0	28.3	164	79.9	236	23.4	143	55.5
Beryllium	µg/g		0.5	<0.5	1.0	<0.5	1.2	<0.5	1.0	<0.5
Boron	µg/g		5	<5	7	9	13	<5	10	<5
Boron (Hot Water Soluble)	µg/g		0.10	0.11	<0.10	0.31	0.11	<0.10	0.10	0.27
Cadmium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g		5	7	72	16	127	10	97	30
Cobalt	µg/g		0.8	2.4	15.5	4.7	21.6	4.2	20.2	5.8
Copper	µg/g		1.0	4.6	16.6	10.4	46.2	13.7	36.3	12.3
Lead	µg/g		1	10	8	7	11	2	9	16
Molybdenum	µg/g		0.5	0.6	<0.5	1.1	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g		1	1	33	7	64	7	51	15
Selenium	µg/g		0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Silver	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Uranium	µg/g		0.50	<0.50	0.96	<0.50	0.81	0.74	0.70	0.64
Vanadium	µg/g		2.0	6.2	65.0	16.6	92.2	18.9	77.0	26.9
Zinc	µg/g		5	11	90	25	106	22	75	46
Chromium, Hexavalent	µg/g		0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, WAD	µg/g		0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g		0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity (2:1)	mS/cm		0.005	0.310	0.845	0.202	0.791	0.172	0.195	0.286
Sodium Adsorption Ratio (2:1) (Calc.)	N/A		N/A	4.75	4.71	1.51	4.10	2.86	1.10	2.57
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.72	6.63	6.67	6.73	6.71	6.70	6.68

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6024428-6024435 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

O. Reg. 406/19 - SPLP Metals

DATE RECEIVED: 2024-07-23

DATE REPORTED: 2024-08-08

		SAMPLE DESCRIPTION:		BH24-2 SS3	BH24-10 SS3	BH24-17 SS4
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2024-07-18	2024-07-22	2024-07-22
Parameter	Unit	G / S	RDL	6024430	6024432	6024434
Antimony Leachate	µg/L		0.6	<0.6	<0.6	<0.6
Arsenic Leachate	µg/L		5	<5	<5	<5
Barium Leachate	µg/L		100	<100	<100	<100
Beryllium Leachate	µg/L		0.8	<0.8	<0.8	<0.8
Boron Leachate	µg/L		500	<500	<500	<500
Cadmium Leachate	µg/L		0.20	<0.20	<0.20	<0.20
Chromium Leachate	µg/L		10	<10	<10	<10
Cobalt Leachate	µg/L		0.3	0.4	<0.3	<0.3
Copper Leachate	µg/L		6.9	<6.9	<6.9	<6.9
Lead Leachate	µg/L		1.0	<1.0	<1.0	<1.0
Molybdenum Leachate	µg/L		1.5	<1.5	<1.5	<1.5
Nickel Leachate	µg/L		10	<10	<10	<10
Selenium Leachate	µg/L		5.0	<5.0	<5.0	<5.0
Silver Leachate	µg/L		0.10	<0.10	<0.10	<0.10
Thallium Leachate	µg/L		0.5	<0.5	<0.5	<0.5
Uranium Leachate	µg/L		2	<2	<2	<2
Vanadium Leachate	µg/L		0.6	5.4	8.5	1.5
Zinc Leachate	µg/L		20	<20	<20	<20

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6024430-6024434 Leachate for metal testing was prepared in accordance with Ontario MECP Method E9003, which has been modified from SW846-1312 by Ontario MECP. MECP has recommended that Method E9003 be used for leachate testing of soil samples under O'Reg 406/19 by MECP.

Samples are past 14 day hold time for leaching.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

O. Reg. 153(511) - PAHs (Soil)

DATE RECEIVED: 2024-07-23

DATE REPORTED: 2024-08-08

		SAMPLE DESCRIPTION:		BH24-1 SS1	BH24-4 SS1	BH24-12 SS2
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2024-07-18	2024-07-19	2024-07-22
Parameter	Unit	G / S	RDL	6024428	6024431	6024433
Naphthalene	µg/g		0.05	<0.05	<0.05	<0.05
Acenaphthylene	µg/g		0.05	<0.05	<0.05	<0.05
Acenaphthene	µg/g		0.05	<0.05	<0.05	<0.05
Fluorene	µg/g		0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/g		0.05	<0.05	<0.05	<0.05
Anthracene	µg/g		0.05	<0.05	<0.05	<0.05
Fluoranthene	µg/g		0.05	<0.05	<0.05	<0.05
Pyrene	µg/g		0.05	<0.05	<0.05	<0.05
Benzo(a)anthracene	µg/g		0.05	<0.05	<0.05	<0.05
Chrysene	µg/g		0.05	<0.05	<0.05	<0.05
Benzo(b)fluoranthene	µg/g		0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	µg/g		0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene	µg/g		0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	µg/g		0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	µg/g		0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	µg/g		0.05	<0.05	<0.05	<0.05
2-and 1-methyl Naphthalene	µg/g		0.05	<0.05	<0.05	<0.05
Moisture Content	%		0.1	3.2	4.6	16.7
Surrogate	Unit	Acceptable Limits				
Naphthalene-d8	%	50-140		75	70	70
Acridine-d9	%	50-140		70	70	75
Terphenyl-d14	%	50-140		85	75	75

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6024428-6024433 Results are based on the dry weight of the soil.
Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: R. Chakraberty

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2024-07-23

DATE REPORTED: 2024-08-08

		SAMPLE DESCRIPTION:		BH24-2 SS3	BH24-10 SS3	BH24-17 SS4	BH24-18 SS6
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2024-07-18	2024-07-22	2024-07-22	2024-07-18
Parameter	Unit	G / S	RDL	6024430	6024432	6024434	6024435
Benzene	µg/g		0.02	<0.02	<0.02	<0.02	<0.02
Toluene	µg/g		0.05	<0.05	<0.05	<0.05	<0.05
Ethylbenzene	µg/g		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
o-Xylene	µg/g		0.05	<0.05	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g		0.05	<0.05	<0.05	<0.05	<0.05
F1 (C6 to C10)	µg/g		5	<5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g		5	<5	<5	<5	<5
F2 (C10 to C16)	µg/g		10	<10	<10	<10	<10
F3 (C16 to C34)	µg/g		50	<50	<50	<50	<50
F4 (C34 to C50)	µg/g		50	<50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA	NA
Moisture Content	%		0.1	21.4	33.2	24.4	21.6
Surrogate	Unit	Acceptable Limits					
Toluene-d8	% Recovery	60-140		70	72	71	68
Terphenyl	%	60-140		80	85	82	90

Certified By: R. Chakraberty

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Certificate of Analysis

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2024-07-23

DATE REPORTED: 2024-08-08

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6024430-6024435 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: R. Chakraberty

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Certificate of Analysis

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2024-07-23

DATE REPORTED: 2024-08-08

		SAMPLE DESCRIPTION:		BH24-1 SS1	BH24-4 SS1	BH24-12 SS2
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2024-07-18	2024-07-19	2024-07-22
Parameter	Unit	G / S	RDL	6024428	6024431	6024433
Benzene	µg/g		0.02	<0.02	<0.02	<0.02
Toluene	µg/g		0.05	<0.05	<0.05	<0.05
Ethylbenzene	µg/g		0.05	<0.05	<0.05	<0.05
m & p-Xylene	µg/g		0.05	<0.05	<0.05	<0.05
o-Xylene	µg/g		0.05	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g		0.05	<0.05	<0.05	<0.05
F1 (C6 to C10)	µg/g		5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g		5	<5	<5	<5
F2 (C10 to C16)	µg/g		10	<10	<10	<10
F2 (C10 to C16) minus Naphthalene	µg/g		10	<10	<10	<10
F3 (C16 to C34)	µg/g		50	<50	<50	<50
F3 (C16 to C34) minus PAHs	µg/g		50	<50	<50	<50
F4 (C34 to C50)	µg/g		50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA
Moisture Content	%		0.1	3.2	4.6	16.7
Surrogate	Unit	Acceptable Limits				
Toluene-d8	% Recovery	60-140		82	84	70
Terphenyl	%	60-140		78	80	85

Certified By: R. Chakraberty

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Certificate of Analysis

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2024-07-23

DATE REPORTED: 2024-08-08

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6024428-6024433 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
C>10 – C16 (F2- Naphthalene) is a calculated parameter. The calculated value is F2 - Naphthalene.
C>16 - C34 (F3-PAH) is a calculated parameter. The calculated value is F3-PAH (PAH: sum of Phenanthrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene and Pyrene).
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: R. Chakraberty

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
AGAT WORK ORDER: 24Z176894
PROJECT: 100117.051
ATTENTION TO: Mohit Bhargav
SAMPLING SITE:Casselman
SAMPLED BY:ML

Soil Analysis

RPT Date: Aug 08, 2024

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	6024428	6024428	<0.8	<0.8	NA	< 0.8	103%	70%	130%	106%	80%	120%	103%	70%	130%
Arsenic	6024428	6024428	1	1	NA	< 1	110%	70%	130%	93%	80%	120%	103%	70%	130%
Barium	6024428	6024428	28.3	25.7	9.6%	< 2.0	98%	70%	130%	92%	80%	120%	89%	70%	130%
Beryllium	6024428	6024428	<0.5	<0.5	NA	< 0.5	116%	70%	130%	105%	80%	120%	136%	70%	130%
Boron	6024428	6024428	<5	<5	NA	< 5	89%	70%	130%	103%	80%	120%	118%	70%	130%
Boron (Hot Water Soluble)	6032472		0.32	0.33	NA	< 0.10	110%	60%	140%	107%	70%	130%	108%	60%	140%
Cadmium	6024428	6024428	<0.5	<0.5	NA	< 0.5	71%	70%	130%	105%	80%	120%	104%	70%	130%
Chromium	6024428	6024428	7	7	NA	< 5	101%	70%	130%	102%	80%	120%	112%	70%	130%
Cobalt	6024428	6024428	2.4	2.4	NA	< 0.8	98%	70%	130%	99%	80%	120%	107%	70%	130%
Copper	6024428	6024428	4.6	4.6	NA	< 1.0	93%	70%	130%	101%	80%	120%	95%	70%	130%
Lead	6024428	6024428	10	10	0.0%	< 1	98%	70%	130%	98%	80%	120%	84%	70%	130%
Molybdenum	6024428	6024428	0.6	0.6	NA	< 0.5	99%	70%	130%	100%	80%	120%	115%	70%	130%
Nickel	6024428	6024428	1	1	NA	< 1	91%	70%	130%	96%	80%	120%	97%	70%	130%
Selenium	6024428	6024428	<0.8	<0.8	NA	< 0.8	97%	70%	130%	100%	80%	120%	105%	70%	130%
Silver	6024428	6024428	<0.5	<0.5	NA	< 0.5	103%	70%	130%	103%	80%	120%	99%	70%	130%
Thallium	6024428	6024428	<0.5	<0.5	NA	< 0.5	100%	70%	130%	103%	80%	120%	94%	70%	130%
Uranium	6024428	6024428	<0.50	<0.50	NA	< 0.50	99%	70%	130%	98%	80%	120%	96%	70%	130%
Vanadium	6024428	6024428	6.2	6.0	NA	< 2.0	117%	70%	130%	91%	80%	120%	106%	70%	130%
Zinc	6024428	6024428	11	12	NA	< 5	104%	70%	130%	106%	80%	120%	118%	70%	130%
Chromium, Hexavalent	6033592		<0.2	<0.2	NA	< 0.2	93%	70%	130%	87%	80%	120%	86%	70%	130%
Cyanide, WAD	6024433	6024433	<0.040	<0.040	NA	< 0.040	97%	70%	130%	84%	80%	120%	93%	70%	130%
Mercury	6024428	6024428	<0.10	<0.10	NA	< 0.10	102%	70%	130%	96%	80%	120%	82%	70%	130%
Electrical Conductivity (2:1)	6024077		0.212	0.193	9.4%	< 0.005	99%	80%	120%						
Sodium Adsorption Ratio (2:1) (Calc.)	6024077		0.256	0.255	0.4%	NA									
pH, 2:1 CaCl2 Extraction	6029768		6.68	6.66	0.3%	NA	102%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

O. Reg. 406/19 - SPLP Metals															
Antimony Leachate	6046420		<0.6	<0.6	NA	< 0.6	101%	70%	130%	106%	80%	120%	105%	70%	130%
Arsenic Leachate	6046420		<5	<5	NA	< 5	101%	70%	130%	104%	80%	120%	104%	70%	130%
Barium Leachate	6046420		<100	<100	NA	< 100	101%	70%	130%	99%	80%	120%	98%	70%	130%
Beryllium Leachate	6046420		<0.8	<0.8	NA	< 0.8	101%	70%	130%	121%	80%	120%	122%	70%	130%
Boron Leachate	6046420		<500	<500	NA	< 500	95%	70%	130%	107%	80%	120%	115%	70%	130%
Cadmium Leachate	6046420		<0.20	<0.20	NA	< 0.20	99%	70%	130%	104%	80%	120%	103%	70%	130%
Chromium Leachate	6046420		<10	<10	NA	< 10	100%	70%	130%	103%	80%	120%	104%	70%	130%
Cobalt Leachate	6046420		<0.3	<0.3	NA	< 0.3	102%	70%	130%	101%	80%	120%	99%	70%	130%

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

Soil Analysis (Continued)

RPT Date: Aug 08, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Copper Leachate	6046420		<6.9	<6.9	NA	< 6.9	99%	70%	130%	101%	80%	120%	102%	70%	130%
Lead Leachate	6046420		<1.0	<1.0	NA	< 1.0	94%	70%	130%	102%	80%	120%	98%	70%	130%
Molybdenum Leachate	6046420		<1.5	1.5	NA	< 1.5	104%	70%	130%	108%	80%	120%	106%	70%	130%
Nickel Leachate	6046420		<10	<10	NA	< 10	99%	70%	130%	108%	80%	120%	106%	70%	130%
Selenium Leachate	6046420		<5.0	<5.0	NA	< 5.0	101%	70%	130%	105%	80%	120%	105%	70%	130%
Silver Leachate	6046420		<0.10	<0.10	NA	< 0.10	100%	70%	130%	103%	80%	120%	101%	70%	130%
Thallium Leachate	6046420		<0.5	<0.5	NA	< 0.5	101%	70%	130%	105%	80%	120%	102%	70%	130%
Uranium Leachate	6046420		<2	<2	NA	< 2	100%	70%	130%	102%	80%	120%	101%	70%	130%
Vanadium Leachate	6046420		<0.6	<0.6	NA	< 0.6	100%	70%	130%	93%	80%	120%	94%	70%	130%
Zinc Leachate	6046420		<20	<20	NA	< 20	100%	70%	130%	103%	80%	120%	130%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

Certified By:

AGAT Laboratories

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AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

Trace Organics Analysis

RPT Date: Aug 08, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PAHs (Soil)															
Naphthalene	6032463		< 0.05	< 0.05	NA	< 0.05	82%	50%	140%	107%	50%	140%	88%	50%	140%
Acenaphthylene	6032463		< 0.05	< 0.05	NA	< 0.05	83%	50%	140%	124%	50%	140%	81%	50%	140%
Acenaphthene	6032463		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	93%	50%	140%	83%	50%	140%
Fluorene	6032463		< 0.05	< 0.05	NA	< 0.05	90%	50%	140%	86%	50%	140%	80%	50%	140%
Phenanthrene	6032463		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	78%	50%	140%	74%	50%	140%
Anthracene	6032463		< 0.05	< 0.05	NA	< 0.05	69%	50%	140%	82%	50%	140%	78%	50%	140%
Fluoranthene	6032463		< 0.05	< 0.05	NA	< 0.05	87%	50%	140%	83%	50%	140%	85%	50%	140%
Pyrene	6032463		< 0.05	< 0.05	NA	< 0.05	87%	50%	140%	81%	50%	140%	83%	50%	140%
Benzo(a)anthracene	6032463		< 0.05	< 0.05	NA	< 0.05	90%	50%	140%	85%	50%	140%	73%	50%	140%
Chrysene	6032463		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	104%	50%	140%	105%	50%	140%
Benzo(b)fluoranthene	6032463		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	84%	50%	140%	80%	50%	140%
Benzo(k)fluoranthene	6032463		< 0.05	< 0.05	NA	< 0.05	81%	50%	140%	93%	50%	140%	88%	50%	140%
Benzo(a)pyrene	6032463		< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	83%	50%	140%	77%	50%	140%
Indeno(1,2,3-cd)pyrene	6032463		< 0.05	< 0.05	NA	< 0.05	81%	50%	140%	69%	50%	140%	65%	50%	140%
Dibenz(a,h)anthracene	6032463		< 0.05	< 0.05	NA	< 0.05	76%	50%	140%	66%	50%	140%	84%	50%	140%
Benzo(g,h,i)perylene	6032463		< 0.05	< 0.05	NA	< 0.05	77%	50%	140%	71%	50%	140%	71%	50%	140%
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)															
Benzene	6024351		<0.02	<0.02	NA	< 0.02	91%	60%	140%	80%	60%	140%	97%	60%	140%
Toluene	6024351		<0.05	<0.05	NA	< 0.05	114%	60%	140%	109%	60%	140%	82%	60%	140%
Ethylbenzene	6024351		<0.05	<0.05	NA	< 0.05	98%	60%	140%	104%	60%	140%	81%	60%	140%
m & p-Xylene	6024351		<0.05	<0.05	NA	< 0.05	110%	60%	140%	115%	60%	140%	88%	60%	140%
o-Xylene	6024351		<0.05	<0.05	NA	< 0.05	115%	60%	140%	118%	60%	140%	89%	60%	140%
F1 (C6 to C10)	6024351		<5	<5	NA	< 5	97%	60%	140%	87%	60%	140%	82%	60%	140%
F2 (C10 to C16)	6029746		< 10	< 10	NA	< 10	98%	60%	140%	89%	60%	140%	98%	60%	140%
F3 (C16 to C34)	6029746		171	150	NA	< 50	102%	60%	140%	110%	60%	140%	90%	60%	140%
F4 (C34 to C50)	6029746		331	332	0.3%	< 50	85%	60%	140%	120%	60%	140%	102%	60%	140%
O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
Benzene	6024351		<0.02	<0.02	NA	< 0.02	91%	60%	140%	80%	60%	140%	97%	60%	140%
Toluene	6024351		<0.05	<0.05	NA	< 0.05	114%	60%	140%	109%	60%	140%	82%	60%	140%
Ethylbenzene	6024351		<0.05	<0.05	NA	< 0.05	98%	60%	140%	104%	60%	140%	81%	60%	140%
m & p-Xylene	6024351		<0.05	<0.05	NA	< 0.05	110%	60%	140%	115%	60%	140%	88%	60%	140%
o-Xylene	6024351		<0.05	<0.05	NA	< 0.05	115%	60%	140%	118%	60%	140%	89%	60%	140%
F1 (C6 to C10)	6024351		<5	<5	NA	< 5	97%	60%	140%	87%	60%	140%	82%	60%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
AGAT WORK ORDER: 24Z176894
PROJECT: 100117.051
ATTENTION TO: Mohit Bhargav
SAMPLING SITE:Casselman
SAMPLED BY:ML

Trace Organics Analysis (Continued)

RPT Date: Aug 08, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By: R. Chakraberty

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QC Exceedance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

RPT Date: Aug 08, 2024

PARAMETER	Sample Id	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
			Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)										
Beryllium	6024428	116%	70%	130%	105%	80%	120%	136%	70%	130%

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

O. Reg. 406/19 - SPLP Metals										
Beryllium Leachate		101%	70%	130%	121%	80%	120%	122%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

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Method Summary

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AGAT WORK ORDER: 24Z176894

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SAMPLING SITE:Casselman

SAMPLED BY:ML

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	SEGMENTED FLOW ANALYSIS
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE
Antimony Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP/MS
Arsenic Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP/MS
Barium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Beryllium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Boron Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS

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Method Summary

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Cadmium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Chromium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Cobalt Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Copper Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Lead Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Molybdenum Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Nickel Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Selenium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Silver Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Thallium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Uranium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Vanadium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Zinc Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Naphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluorene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(a)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Chrysene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(b)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Dibenz(a,h)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
2-and 1-methyl Naphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Moisture Content	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Benzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Toluene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Ethylbenzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
m & p-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
o-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Xylenes (Total)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
F1 (C6 to C10)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	modified from CCME Tier 1 Method	P&T GC/FID
Toluene-d8	VOL-91-5009	modified from EPA SW-846 5030C & 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

AGAT Laboratories

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Method Summary

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z176894

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:Casselman

SAMPLED BY:ML

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Gravimetric Heavy Hydrocarbons	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F2 (C10 to C16) minus Naphthalene	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34) minus PAHs	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

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Have feedback? Scan here for a quick survey!

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Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 24Z176894

Cooler Quantity: one - Ice packs

Arrival Temperatures: 12.9 | 12.5 | 12.1
8.2 | 7.0 | 6.9

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: B I

Report Information:

Company: GEMTEC
Contact: Mohit Bhargav
Address: 32 Steacie Drive
Ottawa, ON, K2K 2A9
Phone: 5068970427 Fax:
Reports to be sent to:
1. Email: mohit.bhargav@gemtec.ca
2. Email: dan.elliot@gemtec.ca

Regulatory Requirements:

(Please check all applicable boxes)

☑ Regulation 153/04
Table ___ *Indicate One*
☐Ind/Com
☐Res/Park
☑Agriculture
Soil Texture *(Check One)*
☐Coarse
☐Fine

☐ Regulation 406
Table ___ *Indicate One*
☐ Regulation 558
☐ CCME

☐ Sewer Use
☐Sanitary ☐Storm
___ *Region*
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
___ *Indicate One*

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply): ___

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 100117.051
Site Location: Casselman
Sampled By: ML
AGAT Quote #: ___ PO: ___
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

	Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	Metals - ☐CrVI, ☑Hg, ☐HWSB	BTEX, F1-F4 PHCs	VOC	PAHs	PCBs	PCBs: Aroclors ☐	O. Reg 558: Landfill Disposal Characterization TCLP: TCLP: ☐M&I ☐VOCs ☐ABNs ☐B(a)P ☐PCBs	O. Reg 406: Regulation 406 SPLP Rainwater Leach SPLP: ☑Metals ☐VOCs ☐SVOCs	Regulation 406 Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Corrosivity: ☐ Moisture ☐ Sulphide						Potentially Hazardous or High Concentration (Y/N)
1.	BH24-1 SS1	July 18, 24	AM	3	S	1x250ml/bag; 1x120ml; 1x vial		☑		☑		☑												
2.	BH24-2 SS3	July 18, 24	↓	↓	↓	↓		↓		↓														
3.	BH24-4 SS1	July 19, 24	↓	↓	↓	↓		↓		↓		✓												
4.	BH24-10 SS3	July 22, 24	↓	↓	↓	↓		↓		↓														
5.	BH24-12 SS2	July 22, 24	↓	↓	↓	↓		↓		↓		✓												
6.	BH24-17 SS4	July 22, 24	↓	↓	↓	↓		↓		↓														
7.	BH24-18 SS6	July 17, 24	↓	↓	↓	↓		↓		↓														
8.			AM PM																					
9.			AM PM																					
10.			AM PM																					
11.			AM PM																					

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Mohit Bhargav	23 July 24	11am	C. Guidotto	07/23/24	13h10
C. Guidotto	07/23/24	15h00	Tiffany	July 24	8:40

Page 1 of 1

Nº:

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CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
32 STEACIE DRIVE
OTTAWA, ON K2K 2A9
(613) 836-1422

ATTENTION TO: Mohit Bhargav

PROJECT: 100117.051

AGAT WORK ORDER: 24Z178590

SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead

TRACE ORGANICS REVIEWED BY: Pinkal Patel, Report Reviewer

DATE REPORTED: Aug 16, 2024

PAGES (INCLUDING COVER): 25

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

VERSION 2:V2 issued 2024-08-16. SPLP Metals added to sample ID BH24-6 SA3 by client request. Supersedes version 1 issued on 2024-08-12. (LB)

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

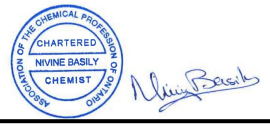
O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

SAMPLE DESCRIPTION:				BH24-6 SA3	BH24-8 SA5	BH24-15 SA3	BH24-16 SS3
SAMPLE TYPE:				Soil	Soil	Soil	Soil
DATE SAMPLED:				2024-07-26	2024-07-26	2024-07-26	2024-07-26
Parameter	Unit	G / S	RDL	6032861	6032884	6032885	6032886
Antimony	µg/g	1	0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	11	1	2	4	2	1
Barium	µg/g	210	2.0	436	43.1	107	73.7
Beryllium	µg/g	2.5	0.5	1.0	<0.5	0.6	<0.5
Boron	µg/g	36	5	10	6	7	5
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.11	<0.10	<0.10	0.13
Cadmium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	67	5	96	11	65	45
Cobalt	µg/g	19	0.8	23.3	4.9	11.0	7.9
Copper	µg/g	62	1.0	45.6	17.2	24.3	15.3
Lead	µg/g	45	1	9	3	6	5
Molybdenum	µg/g	2	0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g	37	1	56	8	33	22
Selenium	µg/g	1.2	0.8	<0.8	<0.8	<0.8	<0.8
Silver	µg/g	0.5	0.5	<0.5	<0.5	<0.5	<0.5
Thallium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5
Uranium	µg/g	1.9	0.50	0.67	0.58	0.83	0.73
Vanadium	µg/g	86	2.0	107	18.9	52.3	36.0
Zinc	µg/g	290	5	131	32	50	37
Chromium, Hexavalent	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, WAD	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.16	0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity (2:1)	mS/cm	0.47	0.005	0.065	0.099	0.160	0.126
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	1	N/A	0.459	0.274	0.301	0.366
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.77	6.82	6.90	6.67

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Agricultural or Other Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6032861-6032886 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

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AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 406/19 - SPLP Metals

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

		SAMPLE DESCRIPTION:		BH24-6 SA3
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-26
Parameter	Unit	G / S	RDL	6032861
Antimony Leachate	µg/L	6	0.6	<0.6
Arsenic Leachate	µg/L	-	5	<5
Barium Leachate	µg/L	-	100	<100
Beryllium Leachate	µg/L	-	0.8	<0.8
Boron Leachate	µg/L	-	500	<500
Cadmium Leachate	µg/L	0.5	0.20	<0.20
Chromium Leachate	µg/L	-	10	<10
Cobalt Leachate	µg/L	-	0.3	<0.3
Copper Leachate	µg/L	-	6.9	<6.9
Lead Leachate	µg/L	-	1.0	<1.0
Molybdenum Leachate	µg/L	23	1.5	<1.5
Nickel Leachate	µg/L	-	10	<10
Selenium Leachate	µg/L	-	5.0	<5.0
Silver Leachate	µg/L	0.3	0.10	<0.10
Thallium Leachate	µg/L	-	0.5	<0.5
Uranium Leachate	µg/L	-	2	<2
Vanadium Leachate	µg/L	-	0.6	7.5
Zinc Leachate	µg/L	-	20	<20

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to 406/19 TABLE 1: Full Depth Background Site Condition – Agriculture (as amended 2024 April 23)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6032861 Leachate for metal testing was prepared in accordance with Ontario MECP Method E9003, which has been modified from SW846-1312 by Ontario MECP. MECP has recommended that Method E9003 be used for leachate testing of soil samples under O'Reg 406/19 by MECP.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - PAHs (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

		SAMPLE DESCRIPTION:		BH24-6 SA3	BH24-15 SA3	BH24-16 SS3
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2024-07-26	2024-07-26	2024-07-26
Parameter	Unit	G / S	RDL	6032861	6032885	6032886
Naphthalene	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Acenaphthylene	µg/g	0.093	0.05	<0.05	<0.05	<0.05
Acenaphthene	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Fluorene	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/g	0.19	0.05	<0.05	<0.05	<0.05
Anthracene	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Fluoranthene	µg/g	0.24	0.05	<0.05	<0.05	<0.05
Pyrene	µg/g	0.19	0.05	<0.05	<0.05	<0.05
Benzo(a)anthracene	µg/g	0.095	0.05	<0.05	<0.05	<0.05
Chrysene	µg/g	0.18	0.05	<0.05	<0.05	<0.05
Benzo(b)fluoranthene	µg/g	0.3	0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.11	0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	µg/g	0.1	0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	µg/g	0.2	0.05	<0.05	<0.05	<0.05
2-and 1-methyl Naphthalene	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Moisture Content	%		0.1	15.2	30.7	9.6
Surrogate	Unit	Acceptable Limits				
Naphthalene-d8	%	50-140		90	100	85
Acridine-d9	%	50-140		85	80	70
Terphenyl-d14	%	50-140		70	75	75

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Agricultural or Other Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6032861-6032886 Results are based on the dry weight of the soil.
Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Pinkal Patel

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

		SAMPLE DESCRIPTION:		BH24-8 SA5
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-26
Parameter	Unit	G / S	RDL	6032884
Benzene	µg/g	0.02	0.02	<0.02
Toluene	µg/g	0.2	0.05	<0.05
Ethylbenzene	µg/g	0.05	0.05	<0.05
m & p-Xylene	µg/g		0.05	<0.05
o-Xylene	µg/g		0.05	<0.05
Xylenes (Total)	µg/g	0.05	0.05	<0.05
F1 (C6 to C10)	µg/g	17	5	<5
F1 (C6 to C10) minus BTEX	µg/g	17	5	<5
F2 (C10 to C16)	µg/g	10	10	<10
F3 (C16 to C34)	µg/g	240	50	<50
F4 (C34 to C50)	µg/g	120	50	<50
Gravimetric Heavy Hydrocarbons	µg/g	120	50	NA
Moisture Content	%		0.1	12.7
Surrogate	Unit	Acceptable Limits		
Toluene-d8	% Recovery	60-140		86
Terphenyl	%	60-140		92

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Agricultural or Other Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6032884 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: 

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs and VOC) (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

		SAMPLE DESCRIPTION:		BH24-16 SS3
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-26
Parameter	Unit	G / S	RDL	6032886
F1 (C6 to C10)	µg/g	17	5	<5
F1 (C6 to C10) minus BTEX	µg/g	17	5	<5
F2 (C10 to C16)	µg/g	10	10	<10
F2 (C10 to C16) minus Naphthalene	µg/g		10	<10
F3 (C16 to C34)	µg/g	240	50	<50
F3 (C16 to C34) minus PAHs	µg/g		50	<50
F4 (C34 to C50)	µg/g	120	50	<50
Gravimetric Heavy Hydrocarbons	µg/g	120	50	NA
Moisture Content	%		0.1	9.6
Surrogate	Unit	Acceptable Limits		
Toluene-d8	%	50-140		102
Terphenyl	%	60-140		68

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Agricultural or Other Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6032886 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX. The calculated parameter is non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
C>10 – C16 (F2- Naphthalene) is a calculated parameter. The calculated value is F2 - Naphthalene.
C>16 - C34 (F3-PAH) is a calculated parameter. The calculated value is F3-PAH (PAH: sum of Phenanthrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene and Pyrene).
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Pinkal Patel

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Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

		SAMPLE DESCRIPTION:		BH24-6 SA3	BH24-15 SA3
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2024-07-26	2024-07-26
Parameter	Unit	G / S	RDL	6032861	6032885
Benzene	µg/g	0.02	0.02	<0.02	<0.02
Toluene	µg/g	0.2	0.05	<0.05	<0.05
Ethylbenzene	µg/g	0.05	0.05	<0.05	<0.05
m & p-Xylene	µg/g		0.05	<0.05	<0.05
o-Xylene	µg/g		0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.05	0.05	<0.05	<0.05
F1 (C6 to C10)	µg/g	17	5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	17	5	<5	<5
F2 (C10 to C16)	µg/g	10	10	<10	<10
F2 (C10 to C16) minus Naphthalene	µg/g		10	<10	<10
F3 (C16 to C34)	µg/g	240	50	<50	<50
F3 (C16 to C34) minus PAHs	µg/g		50	<50	<50
F4 (C34 to C50)	µg/g	120	50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g	120	50	NA	NA
Moisture Content	%		0.1	15.2	30.7
Surrogate	Unit	Acceptable Limits			
Toluene-d8	% Recovery	60-140		104	82
Terphenyl	%	60-140		84	68

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AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Agricultural or Other Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6032861-6032885 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
C>10 – C16 (F2- Naphthalene) is a calculated parameter. The calculated value is F2 - Naphthalene.
C>16 - C34 (F3-PAH) is a calculated parameter. The calculated value is F3-PAH (PAH: sum of Phenanthrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene and Pyrene).
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Jinkal Patel

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AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - VOCs (with PHC) (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

		SAMPLE DESCRIPTION:		BH24-16 SS3
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-26
Parameter	Unit	G / S	RDL	6032886
Dichlorodifluoromethane	µg/g	0.05	0.05	<0.05
Vinyl Chloride	ug/g	0.02	0.02	<0.02
Bromomethane	ug/g	0.05	0.05	<0.05
Trichlorofluoromethane	ug/g	0.05	0.05	<0.05
Acetone	ug/g	0.5	0.50	<0.50
1,1-Dichloroethylene	ug/g	0.05	0.05	<0.05
Methylene Chloride	ug/g	0.05	0.05	<0.05
Trans- 1,2-Dichloroethylene	ug/g	0.05	0.05	<0.05
Methyl tert-butyl Ether	ug/g	0.05	0.05	<0.05
1,1-Dichloroethane	ug/g	0.05	0.02	<0.02
Methyl Ethyl Ketone	ug/g	0.5	0.50	<0.50
Cis- 1,2-Dichloroethylene	ug/g	0.05	0.02	<0.02
Chloroform	ug/g	0.05	0.04	<0.04
1,2-Dichloroethane	ug/g	0.05	0.03	<0.03
1,1,1-Trichloroethane	ug/g	0.05	0.05	<0.05
Carbon Tetrachloride	ug/g	0.05	0.05	<0.05
Benzene	ug/g	0.02	0.02	<0.02
1,2-Dichloropropane	ug/g	0.05	0.03	<0.03
Trichloroethylene	ug/g	0.05	0.03	<0.03
Bromodichloromethane	ug/g	0.05	0.05	<0.05
Methyl Isobutyl Ketone	ug/g	0.5	0.50	<0.50
1,1,2-Trichloroethane	ug/g	0.05	0.04	<0.04
Toluene	ug/g	0.2	0.05	<0.05
Dibromochloromethane	ug/g	0.05	0.05	<0.05
Ethylene Dibromide	ug/g	0.05	0.04	<0.04
Tetrachloroethylene	ug/g	0.05	0.05	<0.05
1,1,1,2-Tetrachloroethane	ug/g	0.05	0.04	<0.04
Chlorobenzene	ug/g	0.05	0.05	<0.05
Ethylbenzene	ug/g	0.05	0.05	<0.05
m & p-Xylene	ug/g		0.05	<0.05

Certified By: Pinkal Patel

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Certificate of Analysis

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

O. Reg. 153(511) - VOCs (with PHC) (Soil)

DATE RECEIVED: 2024-07-26

DATE REPORTED: 2024-08-16

		SAMPLE DESCRIPTION:		BH24-16 SS3
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-26
Parameter	Unit	G / S	RDL	6032886
Bromoform	ug/g	0.05	0.05	<0.05
Styrene	ug/g	0.05	0.05	<0.05
1,1,2,2-Tetrachloroethane	ug/g	0.05	0.05	<0.05
o-Xylene	ug/g		0.05	<0.05
1,3-Dichlorobenzene	ug/g	0.05	0.05	<0.05
1,4-Dichlorobenzene	ug/g	0.05	0.05	<0.05
1,2-Dichlorobenzene	ug/g	0.05	0.05	<0.05
Xylenes (Total)	ug/g	0.05	0.05	<0.05
1,3-Dichloropropene (Cis + Trans)	µg/g	0.05	0.05	<0.05
n-Hexane	µg/g	0.05	0.05	<0.05
Moisture Content	%		0.1	9.6
Surrogate	Unit	Acceptable Limits		
Toluene-d8	% Recovery	50-140		102
4-Bromofluorobenzene	% Recovery	50-140		93

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Agricultural or Other Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6032886 The sample was analyzed using the high level technique. The sample was extracted using methanol, a small amount of the methanol extract was diluted in water and the purge & trap GC/MS analysis was performed. Results are based on the dry weight of the soil.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene + o-Xylene.
1,3-Dichloropropene total is a calculated parameter. The calculated value is the sum of Cis-1,3-Dichloropropene and Trans-1,3-Dichloropropene.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Pinkal Patel

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Exceedance Summary

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
6032861	BH24-6 SA3	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Barium	µg/g	210	436
6032861	BH24-6 SA3	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Chromium	µg/g	67	96
6032861	BH24-6 SA3	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Cobalt	µg/g	19	23.3
6032861	BH24-6 SA3	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Nickel	µg/g	37	56
6032861	BH24-6 SA3	ON T1 S AG	O. Reg. 153(511) - Metals & Inorganics (Soil)	Vanadium	µg/g	86	107

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

Soil Analysis

RPT Date: Aug 16, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	6055763		1.2	1.5	NA	< 0.8	92%	70%	130%	96%	80%	120%	79%	70%	130%
Arsenic	6055763		3	3	NA	< 1	129%	70%	130%	101%	80%	120%	104%	70%	130%
Barium	6055763		67.6	69.5	2.8%	< 2.0	105%	70%	130%	101%	80%	120%	99%	70%	130%
Beryllium	6055763		<0.5	<0.5	NA	< 0.5	97%	70%	130%	107%	80%	120%	114%	70%	130%
Boron	6055763		9	10	NA	< 5	82%	70%	130%	98%	80%	120%	92%	70%	130%
Boron (Hot Water Soluble)	6057704		0.26	0.26	NA	< 0.10	106%	60%	140%	101%	70%	130%	106%	60%	140%
Cadmium	6055763		<0.5	<0.5	NA	< 0.5	72%	70%	130%	98%	80%	120%	97%	70%	130%
Chromium	6055763		16	16	NA	< 5	104%	70%	130%	117%	80%	120%	113%	70%	130%
Cobalt	6055763		5.5	5.5	0.0%	< 0.8	99%	70%	130%	94%	80%	120%	103%	70%	130%
Copper	6055763		63.7	60.8	4.7%	< 1.0	96%	70%	130%	103%	80%	120%	101%	70%	130%
Lead	6055763		46	44	4.4%	< 1	99%	70%	130%	93%	80%	120%	88%	70%	130%
Molybdenum	6055763		<0.5	<0.5	NA	< 0.5	101%	70%	130%	101%	80%	120%	99%	70%	130%
Nickel	6055763		14	14	0.0%	< 1	101%	70%	130%	95%	80%	120%	95%	70%	130%
Selenium	6055763		<0.8	<0.8	NA	< 0.8	98%	70%	130%	102%	80%	120%	102%	70%	130%
Silver	6055763		<0.5	<0.5	NA	< 0.5	98%	70%	130%	95%	80%	120%	110%	70%	130%
Thallium	6055763		<0.5	<0.5	NA	< 0.5	102%	70%	130%	98%	80%	120%	94%	70%	130%
Uranium	6055763		0.54	0.52	NA	< 0.50	107%	70%	130%	95%	80%	120%	96%	70%	130%
Vanadium	6055763		21.5	22.3	3.7%	< 2.0	127%	70%	130%	95%	80%	120%	110%	70%	130%
Zinc	6055763		89	88	1.1%	< 5	102%	70%	130%	105%	80%	120%	108%	70%	130%
Chromium, Hexavalent	6032861	6032861	<0.2	<0.2	NA	< 0.2	99%	70%	130%	90%	80%	120%	81%	70%	130%
Cyanide, WAD	6048593		<0.040	<0.040	NA	< 0.040	108%	70%	130%	104%	80%	120%	98%	70%	130%
Mercury	6055763		<0.10	<0.10	NA	< 0.10	100%	70%	130%	101%	80%	120%	89%	70%	130%
Electrical Conductivity (2:1)	6057704		0.795	0.780	1.9%	< 0.005	102%	80%	120%						
Sodium Adsorption Ratio (2:1) (Calc.)	6057704		5.94	5.86	1.4%	NA									
pH, 2:1 CaCl2 Extraction	6049992		6.72	6.76	0.6%	NA	100%	80%	120%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

O. Reg. 406/19 - SPLP Metals															
Antimony Leachate	6060964		<0.6	<0.6	NA	< 0.6	104%	70%	130%	105%	80%	120%	127%	70%	130%
Arsenic Leachate	6060964		<5	<5	NA	< 5	100%	70%	130%	111%	80%	120%	110%	70%	130%
Barium Leachate	6060964		<100	<100	NA	< 100	99%	70%	130%	102%	80%	120%	101%	70%	130%
Beryllium Leachate	6060964		<0.8	<0.8	NA	< 0.8	112%	70%	130%	112%	80%	120%	137%	70%	130%
Boron Leachate	6060964		<500	<500	NA	< 500	112%	70%	130%	119%	80%	120%	115%	70%	130%
Cadmium Leachate	6060964		<0.20	<0.20	NA	< 0.20	100%	70%	130%	118%	80%	120%	119%	70%	130%
Chromium Leachate	6060964		<10	<10	NA	< 10	100%	70%	130%	101%	80%	120%	102%	70%	130%
Cobalt Leachate	6060964		<0.3	<0.3	NA	< 0.3	100%	70%	130%	100%	80%	120%	101%	70%	130%
Copper Leachate	6060964		<6.9	14.9	NA	< 6.9	101%	70%	130%	100%	80%	120%	101%	70%	130%

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
AGAT WORK ORDER: 24Z178590
PROJECT: 100117.051
ATTENTION TO: Mohit Bhargav
SAMPLING SITE:CASSELMAN
SAMPLED BY:ML

Soil Analysis (Continued)

RPT Date: Aug 16, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Lead Leachate	6060964		<1.0	<1.0	NA	< 1.0	98%	70%	130%	97%	80%	120%	95%	70%	130%
Molybdenum Leachate	6060964		2.9	3.2	NA	< 1.5	99%	70%	130%	102%	80%	120%	100%	70%	130%
Nickel Leachate	6060964		<10	<10	NA	< 10	99%	70%	130%	103%	80%	120%	96%	70%	130%
Selenium Leachate	6060964		<5.0	<5.0	NA	< 5.0	103%	70%	130%	109%	80%	120%	109%	70%	130%
Silver Leachate	6060964		<0.10	<0.10	NA	< 0.10	99%	70%	130%	103%	80%	120%	103%	70%	130%
Thallium Leachate	6060964		<0.5	<0.5	NA	< 0.5	102%	70%	130%	105%	80%	120%	105%	70%	130%
Uranium Leachate	6060964		<2	<2	NA	< 2	100%	70%	130%	98%	80%	120%	96%	70%	130%
Vanadium Leachate	6060964		<0.6	<0.6	NA	< 0.6	102%	70%	130%	104%	80%	120%	103%	70%	130%
Zinc Leachate	6060964		<20	<20	NA	< 20	101%	70%	130%	106%	80%	120%	124%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

Certified By:

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SAMPLING SITE:CASSELMAN
SAMPLED BY:ML

Trace Organics Analysis

RPT Date: Aug 16, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
Benzene	6050044		<0.02	<0.02	NA	< 0.02	80%	60%	140%	71%	60%	140%	87%	60%	140%
Toluene	6050044		<0.05	<0.05	NA	< 0.05	76%	60%	140%	70%	60%	140%	76%	60%	140%
Ethylbenzene	6050044		<0.05	<0.05	NA	< 0.05	78%	60%	140%	70%	60%	140%	81%	60%	140%
m & p-Xylene	6050044		<0.05	<0.05	NA	< 0.05	93%	60%	140%	73%	60%	140%	101%	60%	140%
o-Xylene	6050044		<0.05	<0.05	NA	< 0.05	68%	60%	140%	73%	60%	140%	73%	60%	140%
F1 (C6 to C10)	6050044		<5	<5	NA	< 5	88%	60%	140%	82%	60%	140%	95%	60%	140%
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs and VOC) (Soil)															
F1 (C6 to C10)	6041157		<5	<5	NA	< 5	89%	60%	140%	92%	60%	140%	68%	60%	140%
O. Reg. 153(511) - VOCs (with PHC) (Soil)															
Dichlorodifluoromethane	6041157		<0.05	<0.05	NA	< 0.05	114%	50%	140%	116%	50%	140%	64%	50%	140%
Vinyl Chloride	6041157		<0.02	<0.02	NA	< 0.02	90%	50%	140%	97%	50%	140%	104%	50%	140%
Bromomethane	6041157		<0.05	<0.05	NA	< 0.05	108%	50%	140%	99%	50%	140%	98%	50%	140%
Trichlorofluoromethane	6041157		<0.05	<0.05	NA	< 0.05	79%	50%	140%	119%	50%	140%	77%	50%	140%
Acetone	6041157		<0.50	<0.50	NA	< 0.50	105%	50%	140%	118%	50%	140%	109%	50%	140%
1,1-Dichloroethylene	6041157		<0.05	<0.05	NA	< 0.05	86%	50%	140%	113%	60%	130%	94%	50%	140%
Methylene Chloride	6041157		<0.05	<0.05	NA	< 0.05	81%	50%	140%	82%	60%	130%	107%	50%	140%
Trans- 1,2-Dichloroethylene	6041157		<0.05	<0.05	NA	< 0.05	97%	50%	140%	84%	60%	130%	105%	50%	140%
Methyl tert-butyl Ether	6041157		<0.05	<0.05	NA	< 0.05	102%	50%	140%	105%	60%	130%	65%	50%	140%
1,1-Dichloroethane	6041157		<0.02	<0.02	NA	< 0.02	77%	50%	140%	112%	60%	130%	104%	50%	140%
Methyl Ethyl Ketone	6041157		<0.50	<0.50	NA	< 0.50	85%	50%	140%	98%	50%	140%	85%	50%	140%
Cis- 1,2-Dichloroethylene	6041157		<0.02	<0.02	NA	< 0.02	60%	50%	140%	85%	60%	130%	100%	50%	140%
Chloroform	6041157		<0.04	<0.04	NA	< 0.04	63%	50%	140%	89%	60%	130%	104%	50%	140%
1,2-Dichloroethane	6041157		<0.03	<0.03	NA	< 0.03	69%	50%	140%	77%	60%	130%	110%	50%	140%
1,1,1-Trichloroethane	6041157		<0.05	<0.05	NA	< 0.05	116%	50%	140%	89%	60%	130%	82%	50%	140%
Carbon Tetrachloride	6041157		<0.05	<0.05	NA	< 0.05	72%	50%	140%	98%	60%	130%	85%	50%	140%
Benzene	6041157		<0.02	<0.02	NA	< 0.02	62%	50%	140%	83%	60%	130%	100%	50%	140%
1,2-Dichloropropane	6041157		<0.03	<0.03	NA	< 0.03	89%	50%	140%	82%	60%	130%	90%	50%	140%
Trichloroethylene	6041157		<0.03	<0.03	NA	< 0.03	69%	50%	140%	86%	60%	130%	105%	50%	140%
Bromodichloromethane	6041157		<0.05	<0.05	NA	< 0.05	69%	50%	140%	95%	60%	130%	86%	50%	140%
Methyl Isobutyl Ketone	6041157		<0.50	<0.50	NA	< 0.50	68%	50%	140%	90%	50%	140%	78%	50%	140%
1,1,2-Trichloroethane	6041157		<0.04	<0.04	NA	< 0.04	83%	50%	140%	91%	60%	130%	107%	50%	140%
Toluene	6041157		<0.05	<0.05	NA	< 0.05	62%	50%	140%	96%	60%	130%	118%	50%	140%
Dibromochloromethane	6041157		<0.05	<0.05	NA	< 0.05	70%	50%	140%	103%	60%	130%	90%	50%	140%
Ethylene Dibromide	6041157		<0.04	<0.04	NA	< 0.04	69%	50%	140%	101%	60%	130%	110%	50%	140%
Tetrachloroethylene	6041157		<0.05	<0.05	NA	< 0.05	75%	50%	140%	85%	60%	130%	100%	50%	140%
1,1,1,2-Tetrachloroethane	6041157		<0.04	<0.04	NA	< 0.04	85%	50%	140%	90%	60%	130%	100%	50%	140%
Chlorobenzene	6041157		<0.05	<0.05	NA	< 0.05	69%	50%	140%	94%	60%	130%	111%	50%	140%
Ethylbenzene	6041157		<0.05	<0.05	NA	< 0.05	64%	50%	140%	91%	60%	130%	107%	50%	140%

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
AGAT WORK ORDER: 24Z178590
PROJECT: 100117.051
ATTENTION TO: Mohit Bhargav
SAMPLING SITE:CASSELMAN
SAMPLED BY:ML

Trace Organics Analysis (Continued)

RPT Date: Aug 16, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
m & p-Xylene	6041157		<0.05	<0.05	NA	< 0.05	108%	50%	140%	89%	60%	130%	115%	50%	140%
Bromoform	6041157		<0.05	<0.05	NA	< 0.05	74%	50%	140%	105%	60%	130%	105%	50%	140%
Styrene	6041157		<0.05	<0.05	NA	< 0.05	64%	50%	140%	95%	60%	130%	105%	50%	140%
1,1,2,2-Tetrachloroethane	6041157		<0.05	<0.05	NA	< 0.05	65%	50%	140%	85%	60%	130%	105%	50%	140%
o-Xylene	6041157		<0.05	<0.05	NA	< 0.05	65%	50%	140%	89%	60%	130%	118%	50%	140%
1,3-Dichlorobenzene	6041157		<0.05	<0.05	NA	< 0.05	71%	50%	140%	100%	60%	130%	106%	50%	140%
1,4-Dichlorobenzene	6041157		<0.05	<0.05	NA	< 0.05	78%	50%	140%	108%	60%	130%	115%	50%	140%
1,2-Dichlorobenzene	6041157		<0.05	<0.05	NA	< 0.05	71%	50%	140%	98%	60%	130%	117%	50%	140%
n-Hexane	6041157		<0.05	<0.05	NA	< 0.05	108%	50%	140%	90%	60%	130%	62%	50%	140%
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)															
Benzene	6050044		<0.02	<0.02	NA	< 0.02	80%	60%	140%	71%	60%	140%	87%	60%	140%
Toluene	6050044		<0.05	<0.05	NA	< 0.05	76%	60%	140%	70%	60%	140%	76%	60%	140%
Ethylbenzene	6050044		<0.05	<0.05	NA	< 0.05	78%	60%	140%	70%	60%	140%	81%	60%	140%
m & p-Xylene	6050044		<0.05	<0.05	NA	< 0.05	93%	60%	140%	73%	60%	140%	101%	60%	140%
o-Xylene	6050044		<0.05	<0.05	NA	< 0.05	68%	60%	140%	73%	60%	140%	73%	60%	140%
F1 (C6 to C10)	6050044		<5	<5	NA	< 5	88%	60%	140%	82%	60%	140%	95%	60%	140%
F2 (C10 to C16)	6058530		< 10	< 10	NA	< 10	117%	60%	140%	79%	60%	140%	110%	60%	140%
F3 (C16 to C34)	6058530		< 50	< 50	NA	< 50	125%	60%	140%	70%	60%	140%	100%	60%	140%
F4 (C34 to C50)	6058530		< 50	< 50	NA	< 50	78%	60%	140%	104%	60%	140%	95%	60%	140%
O. Reg. 153(511) - PAHs (Soil)															
Naphthalene	6053733		< 0.05	< 0.05	NA	< 0.05	70%	50%	140%	104%	50%	140%	92%	50%	140%
Acenaphthylene	6053733		< 0.05	< 0.05	NA	< 0.05	79%	50%	140%	95%	50%	140%	92%	50%	140%
Acenaphthene	6053733		< 0.05	< 0.05	NA	< 0.05	82%	50%	140%	111%	50%	140%	93%	50%	140%
Fluorene	6053733		< 0.05	< 0.05	NA	< 0.05	87%	50%	140%	107%	50%	140%	96%	50%	140%
Phenanthrene	6053733		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	108%	50%	140%	99%	50%	140%
Anthracene	6053733		< 0.05	< 0.05	NA	< 0.05	90%	50%	140%	101%	50%	140%	95%	50%	140%
Fluoranthene	6053733		< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	121%	50%	140%	95%	50%	140%
Pyrene	6053733		< 0.05	< 0.05	NA	< 0.05	82%	50%	140%	118%	50%	140%	95%	50%	140%
Benzo(a)anthracene	6053733		< 0.05	< 0.05	NA	< 0.05	100%	50%	140%	76%	50%	140%	92%	50%	140%
Chrysene	6053733		< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	94%	50%	140%	87%	50%	140%
Benzo(b)fluoranthene	6053733		< 0.05	< 0.05	NA	< 0.05	80%	50%	140%	75%	50%	140%	93%	50%	140%
Benzo(k)fluoranthene	6053733		< 0.05	< 0.05	NA	< 0.05	102%	50%	140%	105%	50%	140%	80%	50%	140%
Benzo(a)pyrene	6053733		< 0.05	< 0.05	NA	< 0.05	83%	50%	140%	78%	50%	140%	99%	50%	140%
Indeno(1,2,3-cd)pyrene	6053733		< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	66%	50%	140%	97%	50%	140%
Dibenz(a,h)anthracene	6053733		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	85%	50%	140%	109%	50%	140%
Benzo(g,h,i)perylene	6053733		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	108%	50%	140%	114%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

Trace Organics Analysis (Continued)

RPT Date: Aug 16, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

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QC Exceedance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

RPT Date: Aug 16, 2024

PARAMETER	Sample Id	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
			Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 406/19 - SPLP Metals										
Beryllium Leachate		112%	70%	130%	112%	80%	120%	137%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

More than 90% of the elements met acceptance limits and overall data quality is acceptable for use. For a multi-element scan up to 10% of analytes may exceed the quoted limits by up to 10% absolute.

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Method Summary

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	SEGMENTED FLOW ANALYSIS
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE
Antimony Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP/MS
Arsenic Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP/MS
Barium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Beryllium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Boron Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS

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Method Summary

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Cadmium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Chromium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Cobalt Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Copper Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Lead Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Molybdenum Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Nickel Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Selenium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Silver Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Thallium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Uranium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Vanadium Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS
Zinc Leachate	MET-93-6103	modified from EPA 1312 & EPA 6020B	ICP-MS

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Naphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluorene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(a)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Chrysene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(b)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Dibenz(a,h)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
2-and 1-methyl Naphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Moisture Content	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Benzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Toluene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Ethylbenzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
m & p-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
o-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Xylenes (Total)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
F1 (C6 to C10)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	modified from CCME Tier 1 Method	P&T GC/FID
Toluene-d8	VOL-91-5009	modified from EPA SW-846 5030C & 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Gravimetric Heavy Hydrocarbons	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
F2 (C10 to C16) minus Naphthalene	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34) minus PAHs	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
Dichlorodifluoromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Vinyl Chloride	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Bromomethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Acetone	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methylene Chloride	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Trans- 1,2-Dichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methyl tert-butyl Ether	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Cis- 1,2-Dichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Bromodichloromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Dibromochloromethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS

AGAT Laboratories

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Method Summary

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z178590

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:CASSELMAN

SAMPLED BY:ML

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Ethylene Dibromide	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Chlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Bromoform	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Styrene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
1,3-Dichloropropene (Cis + Trans)	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
n-Hexane	VOL-91-5002	modified from EPA 5035A and EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5002	modified from EPA 5035A & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	modified from EPA 5035A & EPA 8260D	(P&T)GC/MS

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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 24Z178590

Cooler Quantity: one - melted ice

Arrival Temperatures: 9.8 | 9.7 | 9.2
3.9 | 3.8 | 4.0

Custody Seal Intact: ☐ Yes ☐ No ☑ N/A

Notes: B/I

Report Information:

Company: GEMTEC
Contact: Mohit Bhargav
Address: 32 Steacie Drive Ottawa Ontario K2K 2A9
Phone: 5068970427 Fax:
Reports to be sent to:
1. Email: mohit.bhargav@gemtec.ca
2. Email: dan.elliot@gemtec.ca

Regulatory Requirements:

(Please check all applicable boxes)

- ☑ Regulation 153/04 — Table 1 *(Indicate One)*
  - ☐ Ind/Com
  - ☐ Res/Park
  - ☑ Agriculture
- Soil Texture *(Check One)*
  - ☐ Coarse
  - ☐ Fine
- ☐ Excess Soils R406 — Table ____ *(Indicate One)*
- ☐ Regulation 558
- ☐ CCME
- ☐ Sewer Use — ☐ Sanitary ☐ Storm — ____ *Region*
- ☐ Prov. Water Quality Objectives (PWQO)
- ☐ Other ____ *Indicate One*

Is this submission for a Record of Site Condition? ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply): ____

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 100117.051
Site Location: Casselman
Sampled By: ML
AGAT Quote #: ____ PO: ____

Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	BTEX, F1-F4 PHCs / Analyze F4G if required ☑ Yes ☐ No	PAHs	PCBs	VOC	O. Reg 558: Landfill Disposal Characterization TCLP: TCLP: ☐ M&I ☑ VOCs ☐ ABNs ☑ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR								Potentially Hazardous or High Concentration (Y/N)
BH24-6 SA3	26 Jul 2024	AM	3	SOIL	1x120 ml; 1x250 ml/bag; 1xvial		☑		☑	☑														
BH24-8 SA5	26 Jul 2024	AM	3	SOIL	1x120 ml; 1x250 ml/bag; 1xvial		☑		☑															
BH24-15 SA3	26 Jul 2024	AM	3	SOIL	1x120 ml; 1x250 ml/bag; 1xvial		☑		☑	☑														
BH24-16 SS3	26 Jul 2024	AM	3	SOIL	1x120 ml; 1x250 ml/bag; 1xvial		☑		☑	☑		☑												
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Mohit Bhargav	26 July 2024	3 pm	C. Griffith	07/26/24	13h15
C. to Pello	07/26/24	15h00	[illegible signature]	Jul 27	10:42 am

Page 1 of 1

Nº:

Document ID: DIV-78-1511.021

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: March 9, 2021

AGAT Laboratories

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CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS
32 STEACIE DRIVE
OTTAWA, ON K2K 2A9
(613) 836-1422
ATTENTION TO: Mohit Bhargav
PROJECT: 100117.051
AGAT WORK ORDER: 24Z184195
SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead
TRACE ORGANICS REVIEWED BY: Radhika Chakraberty, Trace Organics Lab Manager
DATE REPORTED: Aug 20, 2024
PAGES (INCLUDING COVER): 10
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.*
- *This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

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Certificate of Analysis

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

O. Reg. 558 - Metals & Inorganics

DATE RECEIVED: 2024-08-12

DATE REPORTED: 2024-08-20

		SAMPLE DESCRIPTION:		TCLP
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-31
Parameter	Unit	G / S	RDL	6071900
Arsenic Leachate	mg/L	2.5	0.010	<0.010
Barium Leachate	mg/L	100	0.020	0.682
Boron Leachate	mg/L	500	0.050	<0.050
Cadmium Leachate	mg/L	0.5	0.010	<0.010
Chromium Leachate	mg/L	5	0.050	<0.050
Lead Leachate	mg/L	5	0.010	0.015
Mercury Leachate	mg/L	0.1	0.01	<0.01
Selenium Leachate	mg/L	1	0.020	<0.020
Silver Leachate	mg/L	5	0.010	<0.010
Uranium Leachate	mg/L	10	0.050	<0.050
Fluoride Leachate	mg/L	150	0.10	0.16
Cyanide Leachate	mg/L	20	0.05	<0.05
(Nitrate + Nitrite) as N Leachate	mg/L	1000	0.70	<0.70

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

Flash Point Analysis

DATE RECEIVED: 2024-08-12

DATE REPORTED: 2024-08-20

		SAMPLE DESCRIPTION:		TCLP
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-31
Parameter	**Unit**	**G / S**	**RDL**	**6071900**
Flash point (Pensky Martin Closed Cup)	Deg C		NA	>100

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by *)

Certified By: R. Chakraberty

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Certificate of Analysis

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

O. Reg. 558 - Benzo(a)pyrene

DATE RECEIVED: 2024-08-12

DATE REPORTED: 2024-08-20

		SAMPLE DESCRIPTION:		TCLP
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-31
Parameter	**Unit**	**G / S**	**RDL**	**6071900**
Benzo(a)pyrene Leachate	mg/L	0.001	0.001	<0.001
Surrogate	**Unit**	**Acceptable Limits**		
Acridine-d9	%	50-140		117
Naphthalene-d8	%	50-140		124
Terphenyl-d14	%	50-140		74

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6071900 The sample was leached according to Regulation 558 protocol. Analysis was performed on the leachate.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: R. Chakraberty

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

O. Reg. 558 - VOCs

DATE RECEIVED: 2024-08-12

DATE REPORTED: 2024-08-20

		SAMPLE DESCRIPTION:		TCLP
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2024-07-31
Parameter	Unit	G / S	RDL	6071900
Vinyl Chloride Leachate	mg/L	0.2	0.030	<0.030
1,1 Dichloroethene Leachate	mg/L	1.4	0.020	<0.020
Dichloromethane Leachate	mg/L	5.0	0.030	<0.030
Methyl Ethyl Ketone Leachate	mg/L	200	0.090	<0.090
Chloroform Leachate	mg/L	10.0	0.020	<0.020
1,2-Dichloroethane Leachate	mg/L	0.5	0.020	<0.020
Carbon Tetrachloride Leachate	mg/L	0.5	0.020	<0.020
Benzene Leachate	mg/L	0.5	0.020	<0.020
Trichloroethene Leachate	mg/L	5.0	0.020	<0.020
Tetrachloroethene Leachate	mg/L	3.0	0.050	<0.050
Chlorobenzene Leachate	mg/L	8.0	0.010	<0.010
1,2-Dichlorobenzene Leachate	mg/L	20.0	0.010	<0.010
1,4-Dichlorobenzene Leachate	mg/L	0.5	0.010	<0.010
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	50-140		107
4-Bromofluorobenzene	% Recovery	50-140		96

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

6071900 Sample was prepared using Regulation 558 protocol and a zero headspace extractor.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: R. Chakraberty

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

Soil Analysis

RPT Date: Aug 20, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 558 - Metals & Inorganics															
Arsenic Leachate	6071900	6071900	<0.010	<0.010	NA	< 0.010	99%	70%	130%	115%	80%	120%	122%	70%	130%
Barium Leachate	6071900	6071900	0.682	0.701	2.8%	< 0.020	99%	70%	130%	99%	80%	120%	105%	70%	130%
Boron Leachate	6071900	6071900	<0.050	<0.050	NA	< 0.050	101%	70%	130%	109%	80%	120%	128%	70%	130%
Cadmium Leachate	6071900	6071900	<0.010	<0.010	NA	< 0.010	99%	70%	130%	103%	80%	120%	110%	70%	130%
Chromium Leachate	6071900	6071900	<0.050	<0.050	NA	< 0.050	100%	70%	130%	101%	80%	120%	104%	70%	130%
Lead Leachate	6071900	6071900	0.015	0.015	NA	< 0.010	91%	70%	130%	95%	80%	120%	93%	70%	130%
Mercury Leachate	6071900	6071900	<0.01	<0.01	NA	< 0.01	109%	70%	130%	101%	80%	120%	99%	70%	130%
Selenium Leachate	6071900	6071900	<0.020	<0.020	NA	< 0.020	102%	70%	130%	102%	80%	120%	127%	70%	130%
Silver Leachate	6071900	6071900	<0.010	<0.010	NA	< 0.010	101%	70%	130%	108%	80%	120%	102%	70%	130%
Uranium Leachate	6071900	6071900	<0.050	<0.050	NA	< 0.050	97%	70%	130%	99%	80%	120%	95%	70%	130%
Fluoride Leachate	6071900	6071900	0.16	0.15	NA	< 0.10	105%	90%	110%	107%	90%	110%	122%	70%	130%
Cyanide Leachate	6071900	6071900	<0.05	<0.05	NA	< 0.05	103%	70%	130%	103%	80%	120%	85%	70%	130%
(Nitrate + Nitrite) as N Leachate	6071900	6071900	<0.70	<0.70	NA	< 0.70	102%	80%	120%	104%	80%	120%	102%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

Trace Organics Analysis

RPT Date: Aug 20, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 558 - VOCs															
Vinyl Chloride Leachate	6076551		<0.030	<0.030	NA	< 0.030	110%	50%	140%	103%	50%	140%	100%	50%	140%
1,1 Dichloroethene Leachate	6076551		<0.020	<0.020	NA	< 0.020	90%	50%	140%	103%	60%	130%	92%	50%	140%
Dichloromethane Leachate	6076551		<0.030	<0.030	NA	< 0.030	114%	50%	140%	114%	60%	130%	103%	50%	140%
Methyl Ethyl Ketone Leachate	6076551		<0.090	<0.090	NA	< 0.090	90%	50%	140%	117%	50%	140%	117%	50%	140%
Chloroform Leachate	6076551		<0.020	<0.020	NA	< 0.020	103%	50%	140%	118%	60%	130%	103%	50%	140%
1,2-Dichloroethane Leachate	6076551		<0.020	<0.020	NA	< 0.020	92%	50%	140%	109%	60%	130%	92%	50%	140%
Carbon Tetrachloride Leachate	6076551		<0.020	<0.020	NA	< 0.020	95%	50%	140%	109%	60%	130%	101%	50%	140%
Benzene Leachate	6076551		<0.020	<0.020	NA	< 0.020	101%	50%	140%	113%	60%	130%	96%	50%	140%
Trichloroethene Leachate	6076551		<0.020	<0.020	NA	< 0.020	96%	50%	140%	113%	60%	130%	104%	50%	140%
Tetrachloroethene Leachate	6076551		<0.050	<0.050	NA	< 0.050	109%	50%	140%	116%	60%	130%	95%	50%	140%
Chlorobenzene Leachate	6076551		<0.010	<0.010	NA	< 0.010	111%	50%	140%	108%	60%	130%	92%	50%	140%
1,2-Dichlorobenzene Leachate	6076551		<0.010	<0.010	NA	< 0.010	107%	50%	140%	105%	60%	130%	86%	50%	140%
1,4-Dichlorobenzene Leachate	6076551		<0.010	<0.010	NA	< 0.010	102%	50%	140%	101%	60%	130%	85%	50%	140%
O. Reg. 558 - Benzo(a)pyrene															
Benzo(a)pyrene Leachate	6076157		< 0.001	< 0.001	NA	< 0.001	97%	50%	140%	80%	50%	140%	80%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Flash Point Analysis

Flash Point (Deg C) (Cgy)	4122	Butanol	35	35	NA		100%	80%	120%

Comments: Duplicate NA: results are less than 5X the RDL and RDP will not be calculated.
The sample spikes and dups are not from the same sample ID.

Certified By: R. Chakraberty

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TEL (905)712-5100
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Method Summary

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Arsenic Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Barium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Boron Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Cadmium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Chromium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Lead Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Mercury Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Selenium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Silver Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Uranium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B	ICP-MS
Fluoride Leachate	INOR-93-6000	EPA SW 846-1311; SM 4500F-C	ION SELECTIVE ELECTRODE
Cyanide Leachate	INOR-93-6052	EPA 1311 modified from MOE 3015 SM 4500 CN-I,G387	SEGMENTED FLOW ANALYSIS
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & modified from SM 4500 - NO3- I	LACHAT FIA

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

AGAT WORK ORDER: 24Z184195

PROJECT: 100117.051

ATTENTION TO: Mohit Bhargav

SAMPLING SITE:

SAMPLED BY:ML

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Flash point (Pensky Martin Closed Cup)	TO 2210	ASTM D93	Pensky Martin Closed Cup
Benzo(a)pyrene Leachate	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5105	modified from EPA 3510C and EPA 8270E	GC/MS
Vinyl Chloride Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
1,1 Dichloroethene Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Dichloromethane Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Methyl Ethyl Ketone Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Chloroform Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
1,2-Dichloroethane Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Carbon Tetrachloride Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Benzene Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Trichloroethene Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Tetrachloroethene Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Chlorobenzene Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene Leachate	VOL-91-5001	EPA 1311, modified from EPA 5030C & EPA 8260D	(P&T)GC/MS
Toluene-d8	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS

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5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Laboratory Use Only

Work Order #: 24Z184195

Cooler Quantity: one- no ice packs

Arrival Temperatures: 19.4 | 19.3 | 19.4

~~Depot~~ Temperatures: 6.5 | 6.9 | 7.0

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: BI

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: GEMTEC

Contact: MOHIT BHARGAV

Address: 32 STEACIE DRIVE, OTTAWA ON K2K 2A9

Phone: 5068970427 Fax:

Reports to be sent to:

1. Email: mohit.bhargav@gemtec.ca
2. Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04 — Table (Indicate One): ☐ Ind/Com ☐ Res/Park ☐ Agriculture

Soil Texture (Check One): ☐ Coarse ☐ Fine

☐ Regulation 406 — Table (Indicate One): ☐ Ind/Com ☐ Res/Park ☐ Agriculture

☑ Regulation 558

☐ CCME

☐ Sewer Use: ☐ Sanitary ☐ Storm — Region

☐ Prov. Water Quality Objectives (PWQO)

☐ Other — Indicate One

Is this submission for a **Record of Site Condition (RSC)**? ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT

**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CSR

Project Information:

Project: 100117.051

Site Location:

Sampled By: NL

AGAT Quote #: PO:

Please note: If quotation number is not provided, client will be billed full price for analysis.

Legal Sample ☐

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company:

Contact:

Address:

Email:

Sample Matrix Legend

GW	Ground Water	SD	Sediment
O	Oil	SW	Surface Water
P	Paint	R	Rock/Shale
S	Soil		

Analysis columns: Field Filtered - Metals, Hg, CrVI, DOC (Y / N); O. Reg 153: Metals & Inorganics; Metals - ☐ CrVI, ☐ Hg, ☐ HWSB; BTEX, F1-F4 PHCs; VOC; PAHs; PCBs: Aroclors ☐; O. Reg 406: Regulation 406 Characterization Package; pH, Metals, BTEX, F1-F4; EC, SAR; Regulation 406 SPLP Rainwater Leach; mSPLP: ☐ Metals ☐ VOCs ☐ SVOCs ☐ DOC; O. Reg 558: Landfill Disposal Characterization TCLP: TCLP: ☑ M&I ☑ VOCs ☑ ABNs ☐ B(a)P ☐ PCBs; Corrosivity: ☐ Moisture ☐ Sulphide; Flashpoint; Potentially Hazardous or High Concentration (Y/N)

	Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y / N	Landfill Disposal Characterization TCLP	Flashpoint
1.	TCLP	31 July 24	AM	4	Soil	2x250ml; 2x120ml		✓	✓
2.			AM PM						
3.			AM PM						
4.			AM PM						
5.			AM PM						
6.			AM PM						
7.			AM PM						
8.			AM PM						
9.			AM PM						
10.			AM PM						
11.			AM PM						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Mohit Bhargav	8 12 Aug 24	10 am	C Griffiths	08/12/24	09h50
MOHIT BHARGAV			[illegible]	Aug 13	9:30 A
CG to Purolator	08/12/24	15h00			

Page 1 of 1

Nº: T - 157236

Date Issued: Jan 18, 2024

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT

experience • knowledge • integrity

civil	civil
geotechnical	géotechnique
environmental	environnement
structural	structures
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité

Appendix No. 3

Archaeological Assessments and CHAR Reports

Casselman Main Sewage Pumping Station Upgrade

Corporation of the Village of Casselman

Attachment 1 – Stage 1 Archaeological Assessment

ARCHAEOLOGY | HERITAGE | OUTREACH | CONSERVATION

DRAFT

Stage 1 Archaeological Assessment Casselman Main SPS Upgrades Municipality of Casselman and Municipality of The Nation Lots 8—10, Concession 6 Geographic Township of Cambridge United Counties of Prescott and Russell Former Russell County

Prepared for
Mark St. Pierre, P. Eng
J. L. Richards & Associates Limited
1000-343 Preston Street
Ottawa, ON K1S 1N4
Tel: (343) 803-4554

Licensed under
Craig Ramsoomair
MCM Licence #P1106
PIF # P1106-0051-2024
ARA File #2024-0030

04/02/2025

Original Report

EXECUTIVE SUMMARY

Under a contract awarded in March 2024, Archaeological Research Associates Ltd. carried out a Stage 1 assessment of lands pertaining to the upgrades for the Main Sewage Pumping Station (SPS) located within the Municipality of Casselman, United Counties of Prescott and Russell. The assessment was carried out in support of the Archaeological Screening Process for Municipal Class Environmental Assessments in accordance with the *Environmental Assessment Act.* The results of this assessment will be used to assist with detail design of upgrades to the main sewage pumping station to accommodate long-term projected design flows. The upgrades consist of the installation of a new force main alignment beside the existing force main, modification to existing pumping infrastructure and equipment, and the installation of an emergency gravity bypass overflow to discharge to the South Nation River. This report documents the background research and potential modelling involved in the investigation and presents conclusions and recommendations pertaining to archaeological concerns.

The Stage 1 assessment was conducted on June 15, 2024 under Project Information Form (PIF) #P1106-0051-2024. The investigation encompassed the entire study area. Legal permission was granted to ARA by the proponent to access the subject property. At the time of the assessment, the study area consisted of existing paved and gravel roads, hay pasture and agricultural land, manicured grass, the Main Sewage Pumping Station, raised berms associated with manmade ponds, and existing infrastructure and buried utilities.

The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. Potential for deeply buried human remains and/or burial features was identified in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) in the southeast.

It is recommended that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 *S&Gs*. Deep land alterations have resulted in the removal of archaeological potential from the Casselman Lagoons, Brisson Street and Laurier Street, the extant driveways and parking areas, the lands around the SPS, and lands altered for infrastructure and utilities. The disturbed lands do not require any additional assessment. The current study area does not include the South Nation River but is adjacent. Should any in-water work be planned within the waterway, the Criteria for Evaluating Marine Archaeological Potential checklist should be consulted.

A cemetery investigation must also be carried out in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO.

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ABBREVIATIONS

ARA – Archaeological Research Associates Ltd.
BAO – Bereavement Authority of Ontario
CHVI – Cultural Heritage Value or Interest
MCM – Ministry of Citizenship and Multiculturalism
PIF – Project Information Form
S&Gs – Standards and Guidelines for Consultant Archaeologists
SPS – Sewage Pumping System

PERSONNEL

Project Director: P.J. Racher (#P007)
Operations Manager: C.E. Gohm (#R187)
Project Archaeologist: C. Ramsoomair (#P1106)
Field Director: Monica Maika (#P1021)
Cartographer: M. Johnson
Report Writer: J. Garrett (#P1293)
Editor: C. Ramsoomair

ENGAGED GROUPS

Algonquins of Ontario
Contacts: General Consultation
Field Representative: None

Algonquins of Pikwàkanagàn
Contacts: K. Brethour
Field Representatives: None

Huron-Wendat Nation
Contacts: M.-S. Gendron, D. Lesage
Field Representative: None

Mohawk Council of Akwesasne
Contact: A. Jacobs
Field Representative: None

Métis Nation of Ontario
Contact: General Consultation
Field Representative: None

1.0 PROJECT CONTEXT

1.1 Development Context

Under a contract awarded in March 2024, Archaeological Research Associates Ltd. carried out a Stage 1 assessment of lands pertaining to the upgrades for the Main Sewage Pumping Station (SPS) located within the Municipality of Casselman, United Counties of Prescott and Russell. The assessment was carried out in support of the Archaeological Screening Process for Municipal Class Environmental Assessments in accordance with the *Environmental Assessment Act.* The results of this assessment will be used to assist with detail design of upgrades to the main sewage pumping station to accommodate long-term projected design flows. The upgrades consist of the installation of a new force main alignment beside the existing force main, modification to existing pumping infrastructure and equipment, and the installation of an emergency gravity bypass overflow to discharge to the South Nation River.

The study area consists of an irregular shaped parcel of land with an area of 4.05 ha (Map 1). The parcel is generally bounded by South Nation River to the west, agricultural lands to the north and east, the Town of Casselman and the J.R. Brisson Complex to the south. In legal terms, the study area falls on part of Lots 8-10, Concession 6, Geographic Township of Cambridge, Former Russell County. These lands comprise part of the territory subject to Crawford's Purchases in 1783. They also fall within the proposed Algonquins of Ontario Settlement Area, which will resolve a land claim that was submitted to Canada in 1983 and Ontario in 1985 (Map 2). This claim includes a series of Algonquin petitions dating back as far as 1772. The Algonquins were not consulted about the Crawford's Purchases and are not signatory to the treaty.

The Stage 1 assessment was conducted on June 15, 2024 under Project Information Form (PIF) #P1106-0051-2024. The investigation encompassed the entire study area. Legal permission was granted to ARA by the proponent to access the subject property. As set out in Section 1.0 of the 2011 *Standards and Guidelines for Consultant Archaeologists* (*S&Gs*), the investigation was carried out to achieve the following objectives:

- Provide information about geography, history and current land conditions;
- Determine whether any previous archaeological fieldwork has been completed;
- Evaluate in detail the study area's archaeological potential; and
- Recommend appropriate strategies for Stage 2 assessment, if necessary.

The Ministry of Citizenship and Multiculturalism (MCM) is asked to review the results and recommendations presented herein and enter the report into the Ontario Public Register of Archaeological Reports. A Record of Indigenous Engagement is included in the project report package in accordance with the requirements set out in Section 7.6.2 of the 2011 *S&Gs*.

1.2 Historical Context

After a century of archaeological work in southern Ontario, scholarly understanding of the historical usage of the area has become very well-developed. With occupation beginning in the

Palaeo period approximately 11,000 years ago, the greater vicinity of the study area comprises a complex chronology of Indigenous and Euro-Canadian histories. Section 1.2.1 summarizes the region's settlement history, Section 1.2.2 provides the oral traditions of some of the Indigenous communities whose treaty, traditional and/or ancestral territories include the study area, and Section 1.2.3 documents past and present land uses. Three previous archaeological reports containing relevant background information were obtained during the research component of the study. These reports are summarized in Section 1.3.3, and the references (including title, author and PIF number) appear in Section 7.0.

1.2.1 Settlement History

1.2.1.1 Pre-Contact

The Pre-Contact history of the region is lengthy and rich, and a variety of Indigenous groups inhabited the landscape. Archaeologists generally divide this vibrant history into three main periods: Palaeo, Archaic and Woodland. Each of these periods comprise a range of discrete sub-periods characterized by identifiable trends in material culture and settlement patterns, which are used to interpret past lifeways. The principal characteristics of these sub-periods are summarized in Table 1.

Table 1: Pre-Contact Settlement History
(Wright 1972; Ellis and Ferris 1990; JHA 1993; Warrick 2000; ORHDC 2005; Munson and Jamieson 2013)

Sub-Period	Timeframe	Characteristics
Early Palaeo	9000–8400 BC	Small bands move into southern Ontario; Mobile hunters and gatherers; Utilization of seasonal resources and large territories; Gainey, Barnes and Crowfield traditions; Fluted points; Eastern Ontario was inundated by the Champlain Sea from about 10,000 to 8000 BC
Late Palaeo	8400–7500 BC	Holcombe, Hi-Lo and Lanceolate biface traditions; Continuing mobility; Campsite/Way-Station sites; Smaller territories are utilized; Non-fluted points; Mobile hunters/gatherers may have moved into the Ottawa Valley ca. 8000 BC
Early Archaic	7500–6000 BC	Side-Notched, Corner-Notched (Nettling, Thebes) and Bifurcate traditions; Gulf of Maine Archaic tradition sites are common; Growing diversity of stone tool types; Heavy woodworking tools appear (e.g., ground stone axes and chisels)
Middle Archaic	6000–2500 BC	Laurentian tradition; Reliance on local resources; Populations increasing; More ritual activities; Fully ground and polished tools; Net-sinkers common; Earliest copper tools; Inhabitants likely followed a seasonal round of hunting, fishing and gathering and engaged in long-distance trade for materials
Late Archaic	2500–900 BC	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; Less mobility; Use of fish-weirs; True cemeteries appear; Stone pipes emerge; Long-distance trade (marine shells and galena)
Early Woodland	900–400 BC	Meadowood tradition; Crude cord-roughened ceramics emerge; Meadowood cache blades and side-notched points; Bands of up to 35 people; Middlesex tradition attested late in the period within the St. Lawrence and Ottawa Valleys; Represented primarily by mortuary contexts; Assemblages characterized by blocked-end tubes of ground and polished stone and a variety of large, bifacially worked items (e.g., long leaf-shaped blades, long stemmed blades, etc.)
Middle Woodland	400 BC–AD 600	Point Peninsula tradition; Vinette 2 ceramics appear; Small camp sites and seasonal village sites; Influences from northern Ontario and Hopewell area to the south; Hopewellian influence can be seen in continued use of burial mounds
Middle/Late Woodland Transition	AD 600–900	Gradual transition between Point Peninsula and later traditions; Princess Point tradition emerges elsewhere (i.e., in the vicinity of the Grand and Credit Rivers)

Sub-Period	Timeframe	Characteristics
Late Woodland	AD 900–1600	Area occupied by Algonquian-speaking peoples; Traditions in this region developed alongside those of the Iroquoian-speaking Huron-Petun of southern Ontario; Ceramic styles predominantly derived from the south, but also influences from Lake Superior; Adopted smoking pipes and ossuary burials from the Huron-Petun, but tool traditions and houses were dissimilar; Engaged in frequent dog burials; Practised corn horticulture in a partial way; St. Lawrence Iroquoian and Haudenosaunee presence must also be considered; This area often fell under shared usage due to overlapping territories

During the earlier sub-periods, much of eastern Ontario was characterized by glacial lakes and/or inland seas that resulted in high-water levels that have left a sequence of relict shorelines. Archaeological sites associated with these physiographic features are often located far inland from modern shorelines; they are, therefore, of critical importance for locating early deposits. Many sites in this area are small and have limited artifact assemblages; this lack of 'site visibility' is further compounded by the expedient use of local stone for tools and the sustainability of early lifeways in general. Many scatters in this area likely represent camps, chipping stations or processing areas associated with mobile peoples, utilized during their travels along the local drainage basins while making use of seasonal resources.

This part of Ontario represents the ancestral territory of various Indigenous groups, each with their own land use and settlement pattern tendencies. The Algonquin Nation represents one such group, which comprised many bands whose familial territories were divided by rivers and whose names are often reminiscent of the traditional people of that particular river. The study area lies within the traditional territory of the Onontchataronon, also known as the people of Iroquet after one of their chiefs, who lived along the South Nation River and other lands to the west. There have been few archaeological assessments conducted in the South Nation River drainage basin to date. As a result, we do not yet have a comprehensive understanding of the past land use of the area.

Indigenous settlement within eastern Ontario was late in comparison to other parts of the province due to the presence of the Champlain Sea, which inundated the St. Lawrence Lowland following the retreat of the Laurentide Ice Sheet from about 10,000 BC to 8000 BC (Russell et al. 2011). Although no Palaeo sites were identified during an early archaeological inventory of the South Nation drainage basin, it was noted that they would most likely occur in the higher regions such as the Spencerville and Brockville areas (Daechsel 1980). It is possible that Indigenous peoples followed the changing shoreline of the Champlain Sea and moved into the area late in the period as the crust rebounded and conditions became more favourable. Examples of Late Palaeo artifacts in eastern Ontario include two lanceolate points from Lanark County and a chipped stone semi-lunar ulu from Bob's Lake in the Township of Bedford (Watson 1990, 1999). A Late Palaeo occupation has been noted on Thompson Island in the St. Lawrence River area (Ritchie 1969:18), and non-fluted lanceolate points have been found in the Thousand Islands and north of Kingston along the Cataraqui River (HQI 2000).

Eastern Ontario was actively utilized by Indigenous peoples during the subsequent Archaic period as the ice sheet continued to recede and the climate warmed. Examples of Archaic sites in the region include the Early Archaic Taite site (BjFu-4) south of Becketts Creek in the Township of Cumberland, the Late Archaic Muldoon site (BiFs-1) east of Pendleton and the Lamoureaux site

(BiFs-2) along the South Nation River (Clermont 1999). Gulf of Maine Archaic tradition sites also occur, which date from ca. 7500–4000 BC, and are characterized by the bipolar reduction of quartz and the absence of bifacial reduction (Swayze and McGhee 2011).

Little evidence exists for the Early Woodland period in the vicinity of the study area, although such sites are attested to the west near Arnprior and to the south (IE 2011:4). Middle Woodland sites, on the other hand, are much better documented. Kittle Creek 1 (BgFt-3) appears to be a Middle Woodland campsite that is part of a cluster of sites east of Cannamore in the Township of Winchester, overlooking the north bank of the South Nation River. Chesterville 2 (BgFt-6), a multi-component Late Archaic and Late Woodland campsite, and the Droppo site (BgFt-7), a multi-component site with an Indigenous component of unknown date, are also part of this cluster. Crysler 1 (BhFs-3) is an Indigenous campsite of unknown date on the west bank of the Payne River in the Township of Finch. Late Woodland period sites are often associated with the Algonquin groups noted during the time of European contact, such as the Kichesipirini, Weskarini, Kinounchepirini, Matouweskarini and Onontchataronon (JHA 1993; ORHDC 2005).

1.2.1.2 Post-Contact

The arrival of European explorers and traders at the beginning of the 17th century triggered widespread shifts in Indigenous lifeways and set the stage for the ensuing Euro-Canadian settlement process. Documentation for this period is abundant, ranging from the first sketches of Upper Canada and the written accounts of early explorers to detailed township maps and lengthy histories. The Post-Contact period can be effectively discussed in terms of major historical events, and the principal characteristics associated with these events are summarized in Table 2.

Table 2: Post-Contact Settlement History
(Smith 1846; Coyne 1895; Lajeunesse 1960; Cumming 1972; Ellis and Ferris 1990; JHA 1993; Surtees 1994; ORHDC 2005; AO 2024)

Historical Event	Timeframe	Characteristics
Early Exploration	Early 17th century	Brûlé explores southern Ontario in 1610/11; Champlain travels through in 1613 and 1615/1616, making contact with a number of Indigenous groups (including the Algonquin, Huron-Wendat and other First Nations); European trade goods become increasingly common and begin to put pressure on traditional industries; Names of bands suggest that Algonquin territorial organization was based on watersheds; Nipissings and Algonquins were involved in inter-tribal trade
Increased Contact and Conflict	Mid- to late 17th century	Conflicts between various First Nations during the Beaver Wars result in numerous population shifts; Nipissings and Algonquins tended to avoid the lower Ottawa in the summer due to Iroquois attacks; European explorers continue to document the area, and many Indigenous groups trade directly with the French and English; 'The Great Peace of Montreal' treaty established between roughly 39 different First Nations and New France in 1701
Fur Trade Development	Early to mid-18th century	Growth and spread of the fur trade; Bands of the Algonquin Nation occupied the Ottawa Valley; Many spent their summers at mission villages; Peace between the French and English with the Treaty of Utrecht in 1713; Ethnogenesis of the Métis; Hostilities between French and British lead to the Seven Years' War in 1754; Algonquins, Huron-Wendat and Nipissing part of the Seven Nations that sided with France; French surrender in 1760; Seven Nations agreed to join the Six (formerly Five) Nations Iroquois in one large alliance in the British interest

Historical Event	Timeframe	Characteristics
British Control	Mid- to late 18th century	*Royal Proclamation* of 1763 recognizes the title of the First Nations to the land; Representatives from 24 First Nations attended the Niagara Treaty Council; Numerous treaties subsequently arranged by the Crown; First land cession under the new protocols is the Seneca surrender of the west side of the Niagara River in 1764; The Niagara Purchase (Treaty 381) in 1781 included this area
Loyalist Influx	Late 18th century	United Empire Loyalist influx after the American Revolutionary War (1775–1783); British develop interior communication routes and acquire additional lands; Crawford's Purchases completed in 1783 to provide land for the Loyalists; *Constitutional Act* of 1791 creates Upper and Lower Canada
County Development	Late 18th to early 19th century	Became part of Stormont County in 1792; Russell County established in 1798; Comprised the Townships of Cambridge, Clarence, Cumberland, Gloucester, Osgoode and Russell; Gloucester and Osgoode added to Carleton County in 1838; Initial settlement was slow; Part of the United Counties of Prescott and Russell in 1820; Independent after the abolition of the district system in 1849
Township Formation	Late 18th to mid-19th century	Surveyed by J. Rankin in 1791; First grants went to United Empire Loyalists, including Col. Rankin, Col. Brewerton and the Jessup brothers; Additional survey work conducted by W. Browne in 1822 and D. McDonell in 1834; M. Casselman explored the area and built a hut on the South Nation River in the early 1830s; D. McGillis and Mr. Kennedy were the only documented residents in 1837; Roughly half of the township was held by non-resident, ex-officers
Township Development	Mid-19th to early 20th century	Population reached 102 by 1842; M. Casselman settled near High Falls in 1844, and the McRae, McKinnon and Ferguson families arrived thereafter; 1,165 ha taken up by 1846, with 65 ha under cultivation; 1 saw mill in operation at that time; By 1881, most of the inhabitants were of French Canadian origin; Traversed by the Canada Atlantic Railway (1882) and Ottawa & New York Railway (1898); Communities at Casselman, Grant, Mayerville and St. Albert

Many Algonquins living in this region were Christians but also belonged to traditional bands occupying various watersheds. Traditional band members lived within their hunting grounds for most of the year (ORHDC 2005). Numerous petitions were made to the Crown regarding lands and rights, the earliest of which dates from 1772 and describes the extent of Algonquin and Nipissing territory as encompassing both sides of the Ottawa River from Long Sault to Lake Nipissing (JHA 1993). As Euro-Canadian settlement progressed, Algonquin and Nipissing bands began to press for reserve lands within their own traditional territories (JHA 1993; ORHDC 2005).

In 1798, Algonquin and Nipissing leaders appealed to the Crown to restrict European settlement along the Ottawa River. The Algonquin and Nipissing leaders did not receive a response to their letter, and instead, the lands were further opened for settlement following the conclusion of the War of 1812 and Loyalist land grants in Lanark and Frontenac Counties. Algonquin leaders continued to petition the Crown to acknowledge that the Ottawa Valley lands were Algonquin lands. The government, however, wanted to grant agricultural lands rather than allow the Algonquin lands to remain as hunting grounds. In 1842, Chief Pierre Shawanepinesi petitioned for a tract of 2,000 acres covering parts of the Townships of Oso, Bedford and South Sherbrooke. In 1844, the petition was granted by Order in Council for the 2,000 acres to be set aside under a licence of occupation. The granted lands of the Bedford Reserve continued to be impacted by logging and trespassing of settlers. Chief Shawanepinesi petitioned the government regarding logging and squatters at the Bedford Reserve between 1845 and 1861. Many of the residents of the Bedford Reserve had returned to Kanesatake during this period or moved to Kitigan Zibi, Ardoch and Pikwàkanagàn. By 1861, the Superintendent of Indian Affairs denied the existence of the Bedford Reserve. Even Shawanepinesi left the Bedford Reserve, and by 1881, he had relocated to Pikwàkanagàn (JHA 1993; Bostock and Nelson 2019; Morrison n.d.: 31).

1.2.2 Oral Traditions

The study area occupies lands that fall within the treaty, traditional and/or ancestral territories of numerous First Nations. Indeed, this area was used and shared by many Indigenous groups over the millennia; each with their own traditions as to how they arrived, how they lived, and the major events that punctuated their time there. Amongst these communities, the Algonquins of Ontario also have an oral tradition, presented in the Seven Fire Prophecy wampum belt and the Huron-Wendat were able to provide their own traditional oral historical narrative. These oral histories are reproduced in Table 3–Table 4 (ordered alphabetically). It is hoped that other such accounts can be incorporated into studies like this as they become available. It should be noted that a given oral history does not necessarily reflect the views of other groups or the consultant archaeologist.

Table 3: Algonquins of Ontario Oral History
(Benton-Banai 1979:94–102)

Seven Fire Prophecy
The prophets of the Seven Fires came to the Anishinabe nation when they were residing on the east coast of North America. The visit from the prophets prompted the western migration of the Anishinabe from the east coast, with the Wa-bun-u-keeg' or Daybreak People remaining behind to maintain the eastern fire at the eastern doorway. It is thought that these people were who the French called Abnaki. The prophet of the First Fire encouraged the migration to the west prior to the arrival of European settlers, advising that, "If you do not move, you will be destroyed." The prophet of the First Fire, as recounted by the Mide people, spoke of the first of seven stopping places during the journey west. The first stopping place was a turtle shaped island, the directions to which were thought to be coming from the Creator. A pregnant woman dreamt that she was standing on the back of a turtle in the water, with the turtle's head pointing west and tail pointing east. The dream was accepted by elders and the people were instructed to explore the rivers for the location of the island. The island was found in the St. Lawrence River and it is thought today that it was located at the confluence of the St. Francis River and the St. Lawrence River northeast of Montreal. The second major stopping place on the westward journey was at Ani-mi-kee' wa-bu (Niagara Falls), where the people were greeted by a Sacred Megis Shell (cowrie) that came out of the water. The Sacred Fire was moved to this second major stopping place for a period of time. The third stopping place was described by the prophets as "a place where two great bodies of water are connected by a thin, narrow river." This stopping place was likely along the shores of the Detroit River where it connects to Lake St. Clair, with Lake Huron to the north and Lake Erie to the south. The Sacred Megis is said to have appeared out of the water again to greet the people. It was at this stopping place that the Anishinabe met Haudenosaunee warriors. The Haudenosaunee were pursuing the Anishinabe but later gave them a wampum belt and the pipe of peace was shared. At this time, three groups emerged: the Ish-ko-day'-wa-tomi (fire people, keepers of the Sacred Fire) who are known later as the Potawatomi; the O-daw-wahg' (trader people, providers of food for the nation and in charge of major hunting expeditions) who are known as the Ottawa; and the Ojibway (faith keepers of the nation entrusted with keeping the Sacred Scrolls and the Waterdrum of the Midewiwin) who have sometimes been referred to as Chippewa. The three groups became known as the nation of the Three Fires. Along the way to the fourth stopping place, the nation of Three Fires were attacked by the Sauks and Foxes before they stopped to camp along what is believed to have been the eastern shore of Lake Michigan. Villages were established at the camp while ways to cross the lake were considered and many felt that the group had become lost and had missed the fourth stopping place. During this time, teachings of the Midewiwin Lodge were beginning to be abandoned and Spirit Ceremony and Sweat Lodge waned. Some elders were able to maintain the Sacred Fire. The prophecies said that, "a boy would be born to show the Anishinabe back to the sacred ways." The boy came and dreamt of stones that led across the water and the Mide people led the people back to the Detroit River where they rested on Walpole Island. They then moved northward along the eastern shore of Lake Huron before reaching Manitoulin Island, the fourth major stopping place. The Sacred Megis appeared on the island and the people returned to the Midewiwin Way. It was at this time that the Clan System was established. The migrating group is said to have stayed at Manitoulin Island for a period of time before moving to Baw-wa-ting' (Sault Ste. Marie) where the people again were greeted by the Megis Shell. Baw-wa-ting' became the fifth major stopping place and was abundant in fish to support the people. From Ba-wa-ting', the migration split into two groups, with one group continuing

Seven Fire Prophecy
westward and the other group northward. Both groups encountered the Ba-wahn', later known as Dakotas, whose hunting territory was invaded with the arrival of the Anishinabe. The sixth major stopping place was at Spirit Island at the west end of Lake Superior where the Sacred Shell appeared to the northern group. The words of the prophets were fulfilled at Spirit Island as the Anishinabe found Ma-no'-min (wild rice), "the food that grows on water." The prophets had spoken of a turtle-shaped island that awaited the group at the end of their migration. The southern group saw an island that was located beyond a long point of land that fit the description of the island that they were looking for. The people went to the island and placed tobacco on the shore and were greeted by the Sacred Shell. The Sacred Shell told the people that they had arrived at their last stop of the migration. The seventh and final stop was at Mo-ning-wun'-a-kawn-ing (later called Madeline Island) and the Sacred Fire burned brightly there. It is thought that the migration began in 900 A.D. and took about 500 years to complete, all the while with the Sacred Fire being kept alive.

Table 4: Huron-Wendat Nation Oral History
(Provided by Huron-Wendat First Nation)

Huron-Wendat First Nation Historical/Background context
As an ancient people, traditionally, the Huron-Wendat, a great Iroquoian civilization of farmers and fishermen-hunter-gatherers and also the masters of trade and diplomacy, represented several thousand individuals. They lived in a territory stretching from the Gaspé Peninsula in the Gulf of Saint Lawrence and up along the Saint Lawrence Valley on both sides of the Saint Lawrence River all the way to the Great Lakes. Huronia, included in Wendake South, represents a part of the ancestral territory of the Huron-Wendat Nation in Ontario. It extends from Lake Nipissing in the North to Lake Ontario in the South and Île-Perrot in the East to around Owen Sound in the West. This territory is today marked by several hundred archaeological sites, listed to date, testifying to this strong occupation of the territory by the Nation. It is an invaluable heritage for the Huron-Wendat Nation and the largest archaeological heritage related to a First Nation in Canada. According to our own traditions and customs, the Huron-Wendat are intimately linked to the Saint Lawrence River and its estuary, which is the main route of its activities and way of life. The Huron-Wendat formed alliances and traded goods with other First Nations among the networks that stretched across the continent. Today, the population of the Huron-Wendat Nation is composed of more than 4000 members distributed on-reserve and off-reserve. The Huron-Wendat Nation band council (CNHW) is headquartered in Wendake, the oldest First Nations community in Canada, located on the outskirts of Quebec City (20 km north of the city) on the banks of the Saint Charles River. There is only one Huron-Wendat community, whose ancestral territory is called the Nionwentsïo, which translates to "our beautiful land" in the Wendat language. The Huron-Wendat Nation is also the only authority that have the authority and rights to protect and take care of her ancestral sites in Wendake South.

1.2.3 Past and Present Land Use

During Pre-Contact and Early Contact times, the vicinity of the study area would have comprised a mixture of coniferous trees, deciduous trees and open areas. Indigenous communities actively utilized the land and its resources well into Post-Contact times, and they would have managed the landscape to varying degrees (e.g., establishing clearings for campsites, plant cultivation, etc.). Given that Anishinaabeg populations lived lightly on the land and practised sustainable lifeways, this level of management would have been relatively limited. During the late 18th to early 19th centuries, Euro-Canadian settlers arrived in the area and began to clear the forests for lumbering, agricultural and settlement purposes. The study area was located partly within the historical limits of the Municipality of Casselman.

Examinations of early mapping and aerial imagery were carried out to provide a general framework for reconstructing the history of the Euro-Canadian settlement in the study area. Detailed documentary research of the land use and occupation history specific to the Cemetery on J. Brisson's Farm was also conducted, which involved the consultation of land registry records and additional information sources as set out in Section 3.1 of the 2011 *S&Gs*. The land use at the time of assessment can be classified as a mixture of residential, infrastructural and agricultural.

1.2.3.1 Casselman

The origin of the community of Casselman can be traced to the arrival of Martin Casselman and his subsequent development projects. Casselman, a Loyalist descendant, visited the area in 1832 and decided to establish a village to exploit the abundant lumber resources. In 1843, he purchased 1,600 acres on either side of the river from the Jessup family. Casselman settled near a waterfall on the banks of the river in 1844 and established a dam and sawmill. He was assisted by 40 men, each of whom was promised a parcel of land at a very low price in exchange. The Canada Atlantic Railway arrived in 1882, and a series of devastating fires occurred between 1891 and 1919. In 1891, a fire destroyed the Casselman Lumber Co. and part of the village, and in 1897, a second fire destroyed nearly the entire settlement. In 1919, a third fire destroyed many buildings along the main street, although the church, bank and a store were saved by firemen from Ottawa (MC 2024).

1.2.3.2 Coupal and Laplante Hydroelectric Stations

In 1908, a local businessman named J. N. Coupal began construction on a 140 m (460') dam across the South Nation River and an associated 125 kW powerhouse to provide electricity for his home, grist mill and neighbouring homes. The project was completed in 1910, and the village council granted a 30-year franchise to Coupal to supply electricity to the rest of the village. Coupal closed his grist mill in 1922, increasing the supply to the village as a result. By this time, demand had increased significantly, and some new residents were on two-year waiting lists to receive power. A local power commission was formed in 1924, and a new 10-year contract was negotiated to supply power, part of which required that all surplus money be refunded to customers. The village resumed the terms of the 30-year contract after the 10-year contract expired. By 1952, the demand for electricity had increased beyond the capacity of Coupal's system and the village established a publicly managed utility called Casselman Hydro (CG 2024; HO 2024).

Coupal's plant ceased operations in the mid-1960s. In 1986, a new hydroelectric station was constructed by G. Laplante to provide power to roughly 75 customers in Casselman. This involved the blasting and excavation of a 5 m wide trench along the side of the river and the construction of a powerhouse only a few metres from Coupal's powerhouse (Levere 1986). Casselman Hydro became part of the Hydro Ottawa family in May 2002 (HO 2024). Laplante's powerhouse was still in operation at the time of assessment, and the ruins of the Coupal plant are visible to the south.

1.2.3.3 Doran Park

Doran Park is located on the east bank of the South Nation River and is part of the High Falls Conservation Area (formerly known as the Casselman Conservation Reservoir). The conservation area itself spans both banks of the South Nation River (south of the weir built in 1966) and consists of 5.5 acres of parkland with barbeques, picnic facilities, a floating dock, a boat launch and other

amenities. The area is well known for walleye and pike fishing, and fishing derbies are common. The ruins of J.N. Coupal's dam from 1910 are visible from the boundaries of the park (SNC 2020).

1.2.3.4 Mapping and Imagery Analysis

In order to gain a general understanding of the study area's past land uses, two historical settlement maps, two topographic maps, one aerial image and photographs provided by the proponent were examined during the research component of the study. Specifically, the following resources were consulted:

- *Map of the Counties of Stormont, Dundas, Glengarry, Prescott and Russell, Canada West* (1862) (OHCMP 2019);
- *Prescott and Russell Supplement in the Illustrated Atlas of the Dominion of Canada* (1881) (MU 2001);
- Topographic maps from 1908 and 1936 (OCUL 2024);
- An aerial image from 1954 (U of T 2024); and
- Photos from previous 2005-2007 SPS and Force main Construction (Courtesy of J. L. Richards).

The limits of the study area are shown on georeferenced versions of the consulted historical resources in Map 3–Map 6. Photos from the 2005-2007 SPS, Forcemain and Manhole Construction activities are shown unaltered in Appendix A–Appendix C

The *Map of the Counties of Stormont, Dundas, Glengarry, Prescott and Russell, Canada West* (1862) provides little information concerning past land uses (Map 3). Lot 9, Concession 6 was occupied by M. Casselman and J. McGillivary while no occupants are listed for the other lots. This publication only included information for its subscribers, however, so this is not necessarily an indication that the subject lands were vacant or otherwise unimproved. The study area occupied lands east of the South Nation River. The area is identified as High Falls, and several islands are shown within the river. Martin Casselman's mill appears on the opposite bank and a tributary of the South Nation River traversed the northern part of the study area. The schematic layout of present-day Laurier Street and Brisson Street are illustrated as traversing the study area.

The *Prescott and Russell Supplement in Illustrated Atlas of the Dominion of Canada* (1881) identifies Casselman as well as High Falls but does not reveal any occupants within the study area (Map 4). Among the structures present, Martin Casselman's mill and the Casselman Post Office can be seen depicted on the west bank of the South Nation River. The schematic layout of present-day Principale Street and Laurier Street are illustrated while Brisson Street is now absent.

The topographic maps from 1908 and 1936 illustrate the development of the study area (Map 5). Both depict a brick church and an adjacent building to the southeast of the study area while the northeastern part of the subject lands comprised either cleared or wooded lands traversed by present-day Laurier Street and a tributary of the South Nation River. The 1938 map illustrated the notable development of Coupal's Dam and Powerhouse, built in 1908. It is accompanied by the inclusion of present-day Brisson Street and a frame house. Casselman proper appears to have changed little between 1906 and 1938. The aerial image from 1954 largely confirms this land use

pattern, with the northern part of the study area being used for agriculture (Map 6). The dam and powerhouse are clearly visible, as is the earlier residence along Brisson Street. Although the resolution is poor, some of the lands between the powerhouse and Brisson Street appear to have been impacted.

The current SPS was built in 2005, replacing a prior and smaller structure. The current force main was installed in 2006, and an additional manhole adjacent to the SPS was constructed in 2007. Photos of the construction were provided by J. L. Richards, which demonstrates the deep and intensive impacts associated with the installation of these facilities to the area surrounding the SPS and to the limits of the Brisson to Laurier Street easement (Appendix A–Appendix C).

1.2.3.5 Cemetery on J. Brisson's Farm

The Cemetery on J. Brisson's Farm (CM-03449) comprises an unaddressed L-shaped property located between 806 and 810 Principale Street (Nation View Farm). The visible grave markers fall on the southeast side of the driveway leading to Nation View Farm. The cemetery has several alternate names, including J. Brisson's Farm Cemetery, Doran Farm Road Cemetery, Presbyterian Cemetery, Abandoned Cemetery and Brisson Farm Road Cemetery (OGS 2023). The name used by the Bereavement Authority of Ontario (BAO) has been adopted herein (BAO 2017). The principal transactions documented in the land registry records for this property are summarized in Table 5. A full discussion of the results of the additional historical documentation appears below.

Table 5: Land Transaction Summary
(LRO #50)

Instrument Number	Instrument	Date	Grantor	Grantee	Comments
-	Patent	24 Aug 1796	Crown	Edward Jessup	200 acres
10542	Will	3 Nov 1815	Edward Jessup	-	-
2066	Deed	17 Jul 1835	Susannah Jessup	Hamilton D. Jessup	200 acres
2067	Deed	17 Jul 1835	Hamilton D. Jessup	James Jessup	200 acres
3746	Deed	14 Mar 1843	James Jessup	Martin Casselman	200 acres
1481	Will	20 Aug 1884	Martin Casselman	John S., Martin M. and Ralph A, Casselman	200 acres
12	Plan	18 Dec 1884	H.O. Wood, PLS	R.A. Casselman	-
2975	Deed	21 Jul 1885	Martin M. Casselman and wife	Trustees of the Presbyterian Church	2 acres, 2 roods, 1 perch; Part of Lot EC, Plan of South Casselman
17542	Grant	4 Nov 1944	Trustees of Casselman United Church	David Preston Valley	Part of Lot excepting the cemetery parcel.

The Crown Patent for Lot 10, Concession 6 (200 acres) went to Edward Jessup in August 1796. Jessup was a Loyalist and military member, serving for a time with the King's Royal Regiment of New York and later as captain of the King's Loyal Americans corps before joining Governor Haldimand as major commandant of the Loyal Rangers, later known as Jessup's Rangers (Bowler

1983; Bruin 2023). Following the American Revolutionary War, Jessup and his family moved to Quebec, and Jessup became a land speculator in both Quebec (Lower Canada) and Ontario (Upper Canada). Some of Jessup's land holdings included 3,800 acres on the South Nation River, comprising part of the study area (Bowler 1983). It remains unclear if Jessup's lands within the Township of Cambridge were ever improved during his period of ownership. Jessup and his son founded the Town of Prescott in 1810 (Bowler 1983). Edward Jessup died in 1816, and his lands on Lot 10, Concession 6 were ultimately transferred to James Jessup in 1835.

James Jessup sold the 200-acre lot to Martin Casselman in 1843. Martin Casselman purchased 1,600 acres flanking the South Nation River and settled near the waterfall where he later established a dam and sawmill (MC 2023). Following Casselman's death, Lot 10, Concession 6 (200 acres) was transferred to his sons John, Martin and Ralph in December 1884. In 1885, Ralph Casselman had a plan of survey prepared by H. O. Wood, Provincial Land Surveyor, to subdivide parts of Lots 10 and 11, Concession 6. This was known as the *Plan of South Casselman* (Plan 12), and the study area was located to the east of the subdivided area (LRO #50). In 1885, Martin Casselman (junior) sold 2 acres, 2 roods and 1 perch of Lot 10, Concession 6 to the Trustees of the Presbyterian Church. This parcel formed part of Lot EC on the *Plan of South Casselman* and was situated on the north side of what became Principale Street.

Sometime after the purchase of land, the Trustees of the Presbyterian Church in Casselman built a church on the property. Although the early history of the church remains unknown, a cemetery was also located on the property and it appears that many of the parishioners were of English descent. A devastating fire struck the community of Casselman in October 1897, which destroyed the majority of buildings in the town. Accounts of the fire indicate that more than 800 residences were destroyed, leaving most of the community homeless, with nothing more than the clothes they were wearing as their earthly possessions (Ottawa Journal 1897a). Many of the buildings in Casselman were of frame construction, including the Presbyterian Church. Following the fire, the building committee for the Presbyterian Church promised to rebuild and plans for a brick structure were soon in place (Ottawa Journal 1897b). It is believed that the new church building was constructed in the same location as the original structure on the property. This church remained extant until at least 1919, as a newspaper article notes that a funeral was held there for Mrs. Mary Adams of Casselman in July 1919 (Ottawa Journal 1919).

As time passed, the community of Casselman was increasingly inhabited by Francophones, and many of the street names in the town were changed. In 1944, the Trustees of the Casselman United Church (formerly the Presbyterian Church) sold the church property to David Valley. This sale excluded the cemetery lands, which remain under the ownership of the Trustees of the Congregation of South Casselman Village. A transcription of the 10 visible grave markers was undertaken in 1995 by the Ottawa Branch of the Ontario Genealogical Society, which were associated with the burials of 17 people (Table 6; Map 7). The Bereavement Authority of Ontario was contacted regarding any records they may have regarding the cemetery, but no maps or surveys were on file. The cemetery operator (Municipality of Casselman) was able to provide one additional map, but this only shows the legal cemetery boundary (Map 8). The cemetery is currently inactive, and it remains unclear whether there are any unmarked burials within or beyond the current parcel.

Table 6: Summary of Transcribed Burial Markers
(Davis 2021)

Marker Number	Name	Date(s)
1	Harvey L. Presley	Died September 4, 1911 (7 months)
2	Roderick R. MacLeod	1851–1921
	Mary MacLeod	1837–1929
3	Ada G. Riddell	Died September 8, 1891 (8 months)
4	Harvey E. Riddell	Died November 20, 1910 (18 years, 6 months, 2 days)
5	Edward E. Riddell	Died October 24, 1917 (50 years)
	John Riddell	1832–1907
	Jane Riddell	1837–1920
	Wesley Riddell	1871–1905
6	[broken stone]	Died November 10, 1896 (1 year, 9 months)
7	Clifford D. Brownell	Died March 26, 1907 (1 year, 6 months, 26 days)
8	Joseph E. Brownell	Died July 11, 1906 (79 years, 1 month, 3 days)
	Pollyann Brownell	Died October 3, 1911 (80 years, 11 months, 8 days)
9	Edgar Brownell	Died December 26, 1906 (48 years)
	Sarah Brownell	Died May 24, 1900 (38 years)
	Arthur Brownell	Died August 8, 1901 (3 years)
	Evelina Brownell	Died June 30, 1896 (10 years)
10	Wellesley Johnstone	Died December 19, 1900 (84 years)

1.3 Archaeological Context

The Stage 1 assessment (property inspection) was conducted on June 15, 2024, under PIF #P1106-0051-2024. ARA utilized a Google Pixel 8 with a built-in GPS/GNSS receiver during the investigation (UTM17/NAD83). The limits of the study area were confirmed using project-specific GIS data translated into GPS points for reference in the field, in combination with aerial imagery showing physical features in relation to the subject lands.

The archaeological context of any given study area must be informed by 1) the condition of the property as found (Section 1.3.1), 2) a summary of registered or known archaeological sites located within a minimum 1 km radius (Section 1.3.2) and 3) descriptions of previous archaeological fieldwork carried out within the limits of, or immediately adjacent to the property (Section 1.3.3).

1.3.1 Condition of the Property

The study area lies within the Great Lakes–St. Lawrence forest region, which is a transitional zone between the southern deciduous forest and the northern boreal forest. This region extends along the St. Lawrence River across central Ontario to Lake Huron and west of Lake Superior along the border with Minnesota, and its southern portion extends into the more populated areas of Ontario. It is dominated by hardwood forests, although coniferous trees such as white pine, red pine, hemlock and white cedar commonly mix with deciduous broad-leaved species like yellow birch, sugar and red maples, basswood and red oak (MNRF 2024).

In terms of local physiography, the subject lands fall within the Russell and Prescott Sand Plains. This region encompasses an area of roughly 148,924 ha and comprises a group of large sand plains

separated by the clays of the lower Ottawa Valley. This group consists of one continuous belt extending from Ottawa to Hawkesbury, three fairly large areas to the north and a number of smaller sandy remnants dispersed over the clay plains (Chapman and Putnam 1984:208–210).

According to the Ontario Soil Survey, the study area consists of Castor fine sandy loam, Eroded Channel, Built Up Area, and Achigan soils. Castor fine sandy loam is made up of dark grey, fine sandy soils with layered silt and fine sand parent materials. Castor fine sandy loam is characterized by a gently undulating topography and imperfect drainage qualities. Areas classified as Eroded Channel are characterized by gully-like channels in cultivated areas as well stream-valley slopes. Eroded Channels serve as drainage throughout landscape. Achigan soils are generally coarse sand and gravel with minor components of silt. They are typical of imperfectly drained lands in the region (Wicklund and Richards 1962). Local surficial geology consists primarily of fine-textured glaciomarine deposits in the west, stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain in the south, and fine-textured glaciomarine deposits in the east (OGS 2010). It is also traversed by several meltwater channels and fluvial terraces.

The subject lands fall within the Lower South Nation River drainage basin, which is under the jurisdiction of South Nation Conservation (SNC 2020). Specifically, the study area is traversed by two tributaries of the South Nation River, is immediately adjacent to the South Nation River and is located 129 m south of another tributary and 495 m west of a tributary of Moose Creek.

At the time of the assessment, the study area consisted of existing paved and gravel roads, hay pasture and agricultural land, manicured grass, the Main Sewage Pumping Station, raised berms associated with manmade ponds, and existing infrastructure and buried utilities. Soil conditions were ideal for the activities conducted. No unusual physical features were encountered that affected fieldwork strategy decisions or the identification of artifacts or cultural features (e.g., dense root mats, boulders, rubble, etc.).

1.3.2 Registered or Known Archaeological Sites

The Ontario Archaeological Sites Database and the Ontario Public Register of Archaeological Reports were consulted to determine whether any registered or known archaeological resources occur within a 1 km radius of the study area. The available search facility returned two registered sites located within at least a 1 km radius (the facility returns sites in a rectangular area, rather than a radius, potentially resulting in results beyond the specified distance). Three other registered sites should have also been returned (BhFs-1, BhFs-5 and BhFs-6), but these appear to be missing location information in the database. In terms of other known resources, seven unregistered sites were identified within a 1 km radius of the study area. The sites are summarized in Table 7.

Table 7: Registered or Known Archaeological Sites

Borden No. / ID No.	Site Name / Identifier	Time Period	Affinity	Site Type	Distance from Study Area
BhFs-1	Casselman 1	Woodland, Middle	Indigenous	Unknown	50 m–300 m
BhFs-2	Casselman Dam	Post-Contact	Euro-Canadian	Generating station	50 m–300 m
BhFs-5	-	Pre-Contact, Post-Contact	Indigenous, Euro-Canadian	Scatter	50 m–300 m

Borden No. / ID No.	Site Name / Identifier	Time Period	Affinity	Site Type	Distance from Study Area
BhFs-6	Wimbàbikàn	Pre-Contact, Post-Contact	Indigenous, Euro-Canadian	Scatter	50 m–300 m
BhFs-7	Casselman Village	Post-Contact	Euro-Canadian	House	50 m–300 m
Unregistered	FF1	Pre-Contact	Indigenous	Findspot	50 m–300 m
Unregistered	FF2	Pre-Contact	Indigenous	Findspot	50 m–300 m
Unregistered	FF3	Pre-Contact	Indigenous	Findspot	300 m–1 km
Unregistered	FF4	Pre-Contact	Indigenous	Findspot	300 m–1 km
Unregistered	FF5	Pre-Contact	Indigenous	Findspot	300 m–1 km
Unregistered	FF6	Post-Contact	Euro-Canadian	Scatter	50 m–300 m
Unregistered	FF7	Post-Contact	Euro-Canadian	Scatter	300 m–1 km

None of these sites are located within 50 m and do not have the potential to traverse the study area. As sites located on adjacent lands, BhFs-5 and Wimbàbikàn (BhFs-6) are fully discussed in Section 1.3.3. Casselman 1 (BhFs-1), Casselman Dam (BhFs-2), the Casselman Village site (BhFs-7), FF1, FF2 and FF6 are located within 300 m of the study area and must also be considered as relevant features of archaeological potential. The remaining sites represent more distant archaeological resources.

1.3.3 Previous Archaeological Work

Reports documenting assessments conducted within the subject lands and assessments that resulted in the discovery of sites within adjacent lands were sought during the research component of the study. In order to ensure that all relevant past work was identified, an investigation was launched to identify reports involving assessments within 50 m of the study area. The investigation determined that there are multiple available reports documenting previous archaeological fieldwork within the specified distance. The relevant results and recommendations are summarized below as required by Section 7.5.8 Standards 4–5 of the 2011 *S&Gs* (Map 9).

1.3.3.1 South Nation River Heritage Study

In 1980, H. Daechsel conducted background research and fieldwork as part of an archaeological evaluation of the South Nation River drainage basin under Licence #80-F-0425 (Daechsel 1980). The investigation was carried out as part of the South Nation River Heritage Study, and two relevant papers were generated: Background Paper #3 (Archaeological Resources) and Background Paper #6 (Representative Heritage Resources). These papers include discussions of Casselman 1 (BhFs-1) and the Casselman Dam site (BhFs-2). The specific areas subject to survey were not identified; accordingly, no attempts were made to include this study in the mapping.

Casselman 1 (BhFs-1) was formally identified by J.F. Pendergast in 1959 and may have been visited by W.J. Wintemberg in 1912. Although its exact location remains unknown, it was reportedly documented just north of Casselman on the east bank of the South Nation River. The majority of the original finds consisted of ceramic sherds from the Middle Woodland period, but Daechsel's brief reconnaissance of the area in 1980 failed to relocate the site. Due to its location in the low flood plain area, it was suggested that the site may have eroded away. The associated site record form does not provide any additional information pertaining to the deposit.

Casselman 2, subsequently registered as the Casselman Dam site (BhFs-2), comprises the dam, flume and adjacent powerhouse (referred to as the 'mill portion' in the associated site record form). These features were observed during the survey work in 1980. Although the surrounding soil was thin, surface debris, including ceramics and iron tools, suggested that there was an archaeological component to this industrial site. The site record form states that no artifacts were recovered.

1.3.3.2 Nationview Village Site Development Project (Stages 1–4)

In May 2010, Stage 1 and 2 assessments were carried out for the Nationview Village Site development located at 810 Principale Street under PIF #P325-007-2010 (IE 2011). The assessed area traverses a portion of the study area. The overlapping area was assessed by pedestrian survey at 5 m intervals, but no archaeological resources were identified, and it is of no further concern. The wider investigation resulted in the discovery of nine locations of archaeological materials, none of which are within adjacent lands and have no potential of traversing the study area. BhFs-5 and BhFs-6 were found to be of further cultural heritage value or interest (CHVI), and each site was recommended for a Stage 3 site-specific assessment (IE 2011:13).

In June 2010, the Stage 3 assessments were carried out at sites BhFs-5 and BhFs-6 located under PIF# P325-005-2010 and PIF# P325-006-2010 (IE 2011). Both sites were excavated on a 5 m grid with a total of 34 1 m^2 test units excavated for BhFs-5 and 15 1 m^2 test units excavated for BhFs-6 which yielded 255 and 52 total artifacts, respectively. The assessment results determined that both sites possessed a minor historic component in keeping with agricultural functions. The bulk of the assemblages from both sites were largely Indigenous, and comprised primarily quartz flakes but also included ground stone tools, chert flakes, as well as informal and formal tools made of both cherts and quartz. Onondaga and Kichissippi chert were the primary chert types recovered from both sites, with pot-lidding evident on the sample of Onondaga. It was concluded that both BhFs-5 and BhFs-6 were tool-manufacturing sites, likely dating to the Middle to Late Archaic periods, and require a Stage 4 mitigation of development impacts.

The Stage 4 archaeological excavation of sites BhFs-5 and BhFs-6 occurred between June 2010 to June 2011 under PIFs #P325-009-2020 and #P325-011-2011 (IE 2011a, IE 2011b). A total of 256 1 m^2 block units were excavated for BhFs-5, and 7,376 artifacts were recovered while a total of 106 1m^2 block units were excavated for BhFs-6 with 1,236 artifacts recovered. Due to the aceramic nature of the sites and the presence of ground stone tools, it is suggested that the sites date to the Middle to Late Archaic periods. Impacts to the site were deemed mitigated through full excavation and the sites had no further archaeological concern.

1.3.3.3 Casselman Sentier Brisson Waterfront (Stage 1–2)

In May 2023, a Stage 1 assessment was conducted for the subject project under PIF #P007-1477-2023 (ARA 2023a). The assessed area overlaps the western section of the study area along Brisson Street. The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. It was recommended that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 assessment. The assessed portion that overlaps the current study area was recommended for combination test pit survey and visual inspection to confirm the limits disturbance on the eastern side of Brisson Street, test-pit survey at 5 m intervals on the western side of Brisson Street, while

Brisson Street itself was determined to not possess archaeological potential. Potential for deeply buried human remains and/or burial features was identified in the vicinity of the cemetery on J. Brisson's Farm (CM-03449) in the southeast

The following methods were recommended:

> It is recommended that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 *S&Gs*. Although the areas of exposed bedrock and steep slopes along the river do not require test pit survey, a systematic visual inspection of these lands must be carried out to identify any pictographs, petroglyphs and/or archaeological materials associated with Casselman 1 that could have been exposed by erosion. A cemetery investigation must also be carried out in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the Bereavement Authority of Ontario (BAO). The disturbed and permanently wet lands do not require any additional assessment.
>
> The agricultural fields must be assessed using the pedestrian survey method at an interval of 5 m. All ground surfaces must be recently ploughed (typically within the month prior to assessment), weathered by one heavy rainfall or several light rains, and provide at least 80% visibility. If archaeological materials are encountered, the transect interval must be decreased to at least 1 m and a close inspection of the ground must be conducted over a minimum of a 20 m radius around the find. This interval must be continued until the full extent of the scatter has been defined.
>
> The grassed, overgrown and wooded areas must be assessed using the test pit survey method. A survey interval of 5 m will be required due to the proximity of the lands to the identified features of archaeological potential. Given the likelihood that the grassed areas east of Brisson Street and the overgrown areas northwest, northeast and south of the powerhouse were previously impacted, a combination of visual inspection and test pit survey should be utilized to confirm the extent of disturbance in accordance with Section 2.1.8 of the 2011 *S&Gs*. This will allow for the empirical evaluation of the integrity of the soils and the depth of any impacts as well as facilitate the identification of any archaeological resources associated with the Casselman Dam site. Judgemental test pit survey should similarly be carried out to confirm whether the part of the floodplain adjacent to the South Nation River in the northwest is permanently wet. If these areas are determined to have archaeological potential or if any archaeological materials are found, then a test pit survey interval of 5 m must be maintained.
>
> Each test pit must be excavated into at least the first 5 cm of subsoil (or to bedrock), and the resultant pits must be examined for stratigraphy, potential features and/or evidence of fill. The soil from each test pit must be screened through mesh with an aperture of no greater than 6 mm and examined for archaeological materials. If

> archaeological materials are encountered, all positive test pits must be documented, and intensification may be required.
>
> The cemetery investigation in the vicinity of the Cemetery on J. Brisson's Farm must be preceded by a combination of visual inspection and test pit survey to determine whether there are any surficial archaeological resources. Based on the current landscape and the results of the background research, a 10 m investigation buffer is warranted. Provided that no resources of CHVI are identified, mechanical topsoil removal must be carried out with the 10 m investigation buffer to determine whether any unmarked graves are present. The excavation should begin at the edge of Brisson Street and continue easterly towards the legal cemetery boundary. To avoid damage to potential features and/or human remains, an excavator with an articulated wrist and a flat-edged bucket must be utilized to remove the topsoil. The removals should be conducted incrementally to limit potential impacts to any shallow burials. Mechanical excavation must continue until the topsoil/subsoil interface is reached; this interface must then be subjected to a close examination for potential features and shovel shined or trowelled to further clarify the interface in accordance with the requirements set out in Section 4.2.3 of the 2011 *S&Gs*.
>
> If any burial features (e.g., grave shafts or coffin stains) are encountered, they must be fully documented in order to satisfy the requirements and objectives set out in the *Funeral, Burial and Cremation Services Act, 2002*, Section 174 of Ontario Regulation 30/11 as well as Section 4.2.1 Standard 9 and Section 4.2.2 Standard 7 of the 2011 *S&Gs*. Authorization from the BAO would be required before any further excavation to confirm the presence/absence of human remains. Disarticulated human remains found in secondary contexts must also be recorded. Mechanical excavation must be extended for a minimum of 10 m beyond any burial features (ARA 2023a:16–17).

These recommendations were broadly adopted for the subject investigation except for areas documented as previously disturbed in Appendix A–Appendix C and adjustments to areas requiring cemetery investigation due to improved topographic information for the limits of the Cemetery on J. Brisson's Farm.

The Stage 2 archaeological assessment for these lands along the northern extent of Brisson Street were completed in November 2023 under PIF #P1146-0017-2023 (ARA 2024a). The southeast section of this assessment overlapped with the current study area. These lands were subject to visual inspection, test pit survey at 5 m intervals, and a combination of visual inspection and test pit survey. No archaeological resources were identified, and no further work was recommended. At the time of writing, the associated reports for the Stage 1 and 2 assessments are presently under Ministry review and have not been entered into the Ontario Public Register of Archaeological Reports. Until such a time, their results are considered preliminary.

2.0 STAGE 1 BACKGROUND STUDY

2.1 Background

The Stage 1 assessment involved background research to document the geography, history, previous archaeological fieldwork and current land condition of the study area. This desktop examination included research from archival sources, archaeological publications and online databases. It also included the analysis of a variety of historical maps and aerial imagery. The results of the research conducted for the background study are summarized below.

With occupation beginning approximately 10,000 years ago, the greater vicinity of the study area comprises a complex chronology of Pre-Contact and Post-Contact histories (Section 1.2.1). Artifacts associated with Archaic, Woodland and Early Contact traditions are relatively well-attested in the United Counties of Prescott and Russell, and Euro-Canadian archaeological sites dating to pre-1900 and post-1900 contexts are likewise common. The presence of 12 previously identified sites in the surrounding area demonstrates the desirability of this locality for early settlement (Section 1.3.2). Background research determined that an early archaeological survey included near the study area (Section 1.3.3).

The natural environment of the study area would have been attractive to both Indigenous and Euro-Canadian populations as a result of proximity to the South Nation River and its tributaries. The relatively well-drained soils and fluvial terraces would have been ideal for occupation and agriculture, and the diverse local vegetation would also have encouraged settlement throughout Ontario's lengthy history. Euro-Canadian populations would have been particularly drawn to the logging opportunities in the area and later to the thoroughfares and amenities within the historical community of Casselman.

In summary, the background study included an up-to-date listing of sites from the Ontario Archaeological Sites Database (within at least a 1 km radius), the consideration of previous local archaeological fieldwork (within at least a 50 m radius), the analysis of historical maps (at the most detailed scale available) and the study of aerial imagery. ARA, therefore, confirms that the standards for background research set out in Section 1.1 of the 2011 *S&Gs* were met.

2.2 Field Methods (Property Inspection)

In order to gain first-hand knowledge of the geography, topography and current condition of the study area, a property inspection was conducted on June 15, 2024. Environmental conditions were ideal during the inspection, with partial clouds, bright lighting and a temperature of 18 °C. ARA, therefore, confirms that fieldwork was carried out under weather and lighting conditions that met the requirements set out in Section 1.2 Standard 2 of the 2011 *S&Gs*.

The study area was subjected to systematic inspection, beginning in the northeast and continuing in a roughly linear manner to the southwest corner of the study area. The inspection confirmed that all surficial features of archaeological potential were present where they were previously identified and did not result in the identification of any additional features of archaeological potential not visible on mapping (e.g., relic water channels, patches of well-drained soils, etc.).

The inspection determined that several parts of the study area were disturbed by past construction activities. No other natural features (e.g., overgrown vegetation, heavier soils than expected, etc.) that would affect assessment strategies were identified. The Cemetery on J. Brisson's Farm was visible to the east of Brisson Street and was photo-documented and discussed in Section 2.3. Multiple built heritage resources and cultural heritage landscapes were identified during ARA's heritage assessments for the current and adjacent projects (ARA 2023a; ARA 2024b). No other significant built features (e.g., monuments, etc.) were encountered.

2.3 Analysis and Conclusions

In addition to relevant historical sources and the results of past archaeological assessments, the archaeological potential of a property can be assessed using its soils, hydrology and landforms as considerations. Section 1.3.1 of the 2011 *S&Gs* recognizes the following features or characteristics as indicators of archaeological potential: previously identified sites, water sources (past and present), elevated topography, pockets of well-drained sandy soil, distinctive land formations, resource areas, areas of Euro-Canadian settlement, early transportation routes, listed or designated properties, historic landmarks or sites, and areas that local histories or informants have identified with possible sites, events, activities or occupations.

The Stage 1 assessment resulted in the identification of several features of archaeological potential in the vicinity of the study area (Map 10). The closest and most relevant indicators of archaeological potential (i.e., those that would affect survey interval requirements) include multiple previously identified sites (i.e. BhFs-5 and BhFs-6), several primary water sources (the South Nation River and its tributaries), multiple physiographic landforms (terraces and eroded channels), one historical railway (the Canada Atlantic Railway), two historical roadways (Principale Street and Laurier Street) and one historical cemetery (the Cemetery on J. Brisson's Farm).

Background research determined that the Cemetery on J. Brisson's Farm falls within lands sold to the Trustees of the Presbyterian Church in 1885. A frame church and cemetery were subsequently established on the property, and the church was rebuilt in brick following its destruction in 1897. The church likely went out of use prior to the sale of the land to David Valley in 1944, which excluded the cemetery portion. There are currently 10 visible grave makers associated with the burials of 17 individuals within the cemetery parcel, the earliest of which dates to 1891. There are no plot maps or other records available that provide any reliable indication of the extent of the burial ground. The cemetery, therefore, does not have clearly defined historical boundaries, and it is possible that some interments occurred beyond the legal property limits. ARA determined that the parts of the study area falling within 10 m of the cemetery have the potential for deeply buried burial features (ARA, 2023a). Background research identified the potential for deeply buried human remains and/or burial features was identified in the vicinity of the cemetery on J. Brisson's Farm (CM-03449) in the southeast

Although proximity to a feature of archaeological potential is a significant factor in the potential modelling process, current land conditions must also be considered. Section 1.3.2 of the 2011 *S&Gs* emphasizes that 1) quarrying, 2) major landscaping involving grading below topsoil, 3) building footprints and 4) sewage/infrastructure development can result in the removal of archaeological potential, and Section 2.1 states that 1) permanently wet areas, 2) exposed bedrock

and 3) steep slopes (> 20°) in areas unlikely to contain pictographs or petroglyphs can also be evaluated as having no or low archaeological potential. Areas previously assessed and not recommended for further work also require no further assessment.

Three assessments overlap the current study area. The Stage 1 assessment under PIF #P007-1477-2023 still has several recommendations in the southwest of the study area not previously addressed by PIF #P1146-0017-2023. These areas remain of further archaeological concern. These recommendations were broadly adopted for the subject investigation except for areas documented as previously disturbed in Appendix A–Appendix C. Updated and more accurate topographic information for the study area provided by the client resulted in a shift eastward of the areas within 10 m of the cemetery that required cemetery investigation for deeply buried potential. Areas assessed by the subsequent Stage 2 are of no further concern pending review of the report by the MCM. The northwest is overlapped by areas assessed under PIF #P325-007-2010, which meet current provincial standards (i.e. Pedestrian survey at 5 m) and, as such, do not require additional assessment and are of no further concern.

ARA's visual inspection, coupled with the analysis of historical sources and digital environmental data, resulted in the identification of multiple areas of no archaeological potential. Specifically, deep land alterations have resulted in the removal of archaeological potential from the Casselman Lagoons, Brisson Street and Laurier Street, the extant driveways and parking areas, the lands around the SPS, and lands altered for infrastructure and utilities (Image 1–Image 17). These areas have clearly been impacted by past earth-moving/construction activities, resulting in the disturbance of the original soils to a significant depth and severe damage to the integrity of any archaeological resources. Determining the level and extent of the disturbance was assisted by images provided by J. L. Richards (Appendix A–Appendix C).

The remaining unassessed lands have the potential for Indigenous and Euro-Canadian archaeological materials or require a test pit survey to confirm that they have no archaeological potential (Image 18-Image 19). Areas that possess archaeological potential include the manicured greenspace to the east of Brisson Street and the wooded areas west of the SPS. It seems likely that the lands immediately adjacent to the eastern extent of Brisson Street were previously impacted, but the extent of the disturbance could not be verified based on the inspection alone. These lands have been categorized as areas of archaeological potential and must be empirically tested to confirm that they have no archaeological potential. The Cemetery on J. Brisson's Farm was observed, noting that the extant grave markers remain concentrated in the larger northwestern section of the cemetery as previously noted by the Cemetery Sketch Map (Image 20–Image 24; Map 7).

In summary, the Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. Potential for deeply buried human remains and/or burial features was identified in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) in the southeast. The potential modelling results are presented in Map 11. The study area is depicted as a layer in this map.

3.0 RECOMMENDATIONS

The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. Potential for deeply buried human remains and/or burial features was identified in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) in the southeast.

It is recommended that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 *S&Gs*. Deep land alterations have resulted in the removal of archaeological potential from the Casselman Lagoons, Brisson Street and Laurier Street, the extant driveways and parking areas, the lands around the SPS, and lands altered for infrastructure and utilities. The disturbed lands do not require any additional assessment. The current study area does not include the South Nation River but is adjacent. Should any in-water work be planned within the waterway, the Criteria for Evaluating Marine Archaeological Potential checklist should be consulted.

A cemetery investigation must also be carried out in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO.

The grassed areas to the east of Brisson Street and the wooded areas west of the SPS must be assessed using the test pit survey method. A survey interval of 5 m will be required due to the proximity of the lands to the identified features of archaeological potential. Given the likelihood that the grassed areas east of Brisson Street and immediately adjacent to the roadway were previously impacted, a combination of visual inspection and test pit survey should be utilized to confirm the extent of disturbance in accordance with Section 2.1.8 of the 2011 *S&Gs*. This will allow for the empirical evaluation of the integrity of the soils and the depth of any impacts as well as facilitate the identification of any archaeological resources.

The cemetery investigation in the vicinity of the Cemetery on J. Brisson's Farm must be preceded by a combination of visual inspection and test pit survey to determine whether there are any surficial archaeological resources. Based on the current landscape and the results of the background research, a 10 m investigation buffer is warranted. Provided that no archaeological resources with CHVI are identified, mechanical topsoil removal must then be carried out within the 10 m investigation buffer to determine whether any unmarked graves are present. The excavation should begin at the edge of Brisson Street and continue easterly towards the legal cemetery boundary. To avoid damage to potential features and/or human remains, an excavator with an articulated wrist and a flat-edged bucket must be utilized to remove the topsoil. The removals should be conducted incrementally to limit potential impacts to any shallow burials. Mechanical excavation must continue until the topsoil/subsoil interface is reached; this interface must then be subjected to a close examination for potential features and shovel shined or trowelled to further clarify the interface in accordance with the requirements set out in Section 4.2.3 of the 2011 *S&Gs*.

If any burial features (e.g., grave shafts or coffin stains) are encountered, they must be fully documented in order to satisfy the requirements and objectives set out in the *Funeral, Burial and Cremation Services Act, 2002*, Section 174 of Ontario Regulation 30/11 as well as Section 4.2.1 Standard 9 and Section 4.2.2 Standard 7 of the 2011 *S&Gs*. Authorization from the BAO would be required before any further excavation to confirm the presence/absence of human remains. Disarticulated human remains found in secondary contexts must also be recorded. Mechanical excavation must be extended for a minimum of 10 m beyond any burial features.

4.0 ADVICE ON COMPLIANCE WITH LEGISLATION

Section 7.5.9 of the 2011 *S&Gs* requires that the following information be provided for the benefit of the proponent and approval authority in the land use planning and development process:

- This report is submitted to the Minister of Citizenship and Multiculturalism as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MCM, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.
- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar at the Ministry of Public and Business Service Delivery.

5.0 IMAGES

Image 1: Disturbed Lands
(June 15, 2024; Facing South)

Image 2: Disturbed Lands
(June 15, 2024; Facing South)

Image 3: Disturbed Lands
(June 15, 2024; Facing East)

Image 4: Disturbed Lands
(June 15, 2024; Facing Southwest)

Image 5: Disturbed Lands
(June 15, 2024; Facing West)

Image 6: Disturbed Lands
(June 15, 2024; Facing East)

Image 7: Disturbed Lands
(June 15, 2024; Facing North)

Image 8: Disturbed Lands
(June 15, 2024; Facing South)

Image 9: Disturbed Lands
(June 15, 2024; Facing North)

Image 10: Disturbed Lands
(June 15, 2024; Facing West)

Image 11: Disturbed Lands
(June 15, 2024; Facing East)

Image 12: Disturbed Lands
(June 15, 2024; Facing East)

Image 13: Disturbed Lands
(June 15, 2024; Facing East)

Image 14: Disturbed Lands
(June 15, 2024; Facing South)

Image 15: Disturbed Lands
(June 15, 2024; Facing Southwest)

Image 16: Disturbed Lands
(June 15, 2024; Facing Northwest)

Image 17: Disturbed Lands
(June 15, 2024; Facing West)

Image 18: Area of Potential
(June 15, 2024; Facing North)

Image 19: Area of Mixed Potential
(June 15, 2024; Facing Northeast)

Image 20: Cemetery on J. Brisson's Farm
(June 15, 2024; Facing Northeast)

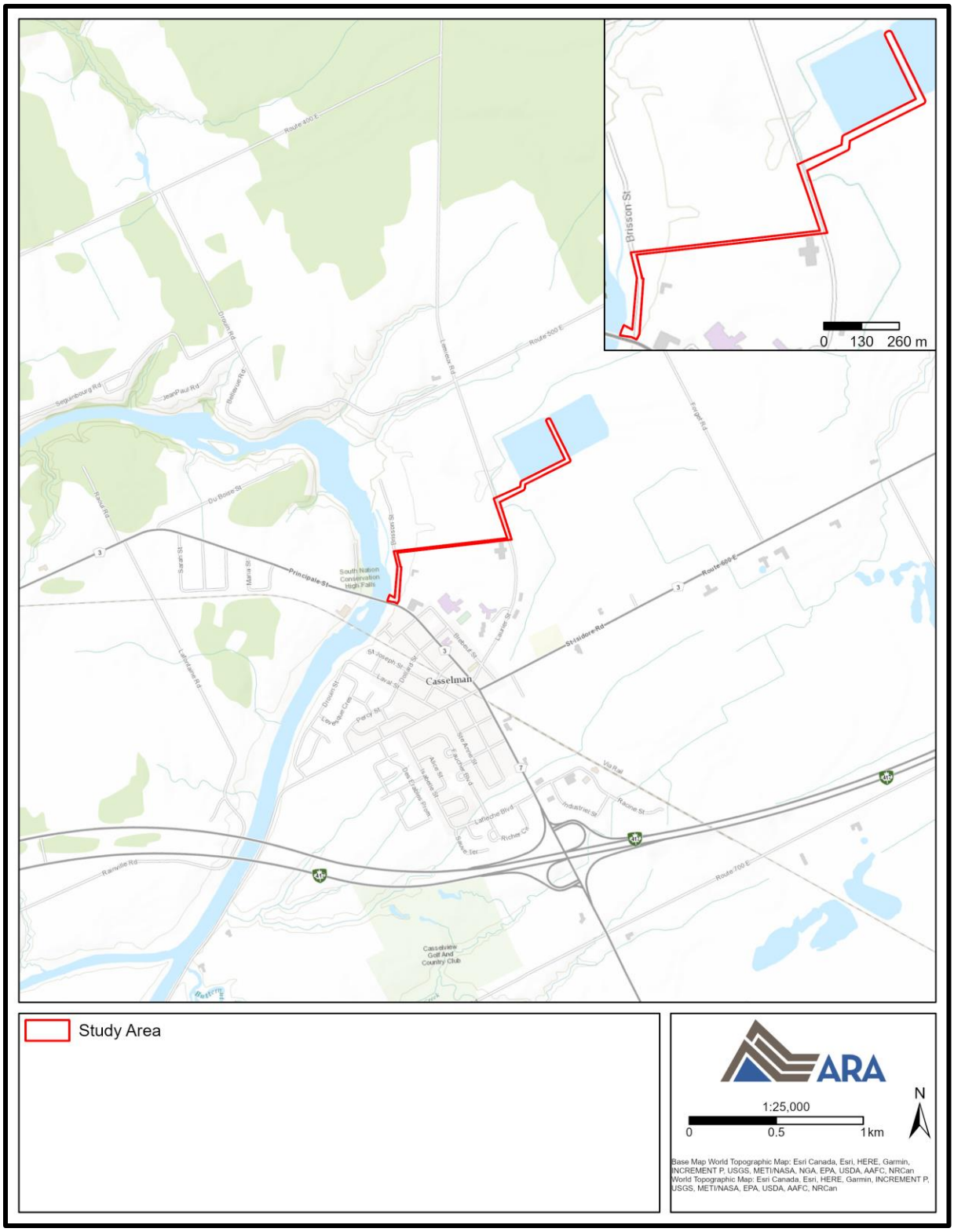
Image 21: Cemetery on J. Brisson's Farm
(June 15, 2024; Facing South)

Image 22: Cemetery on J. Brisson's Farm
(June 15, 2024; Facing West)

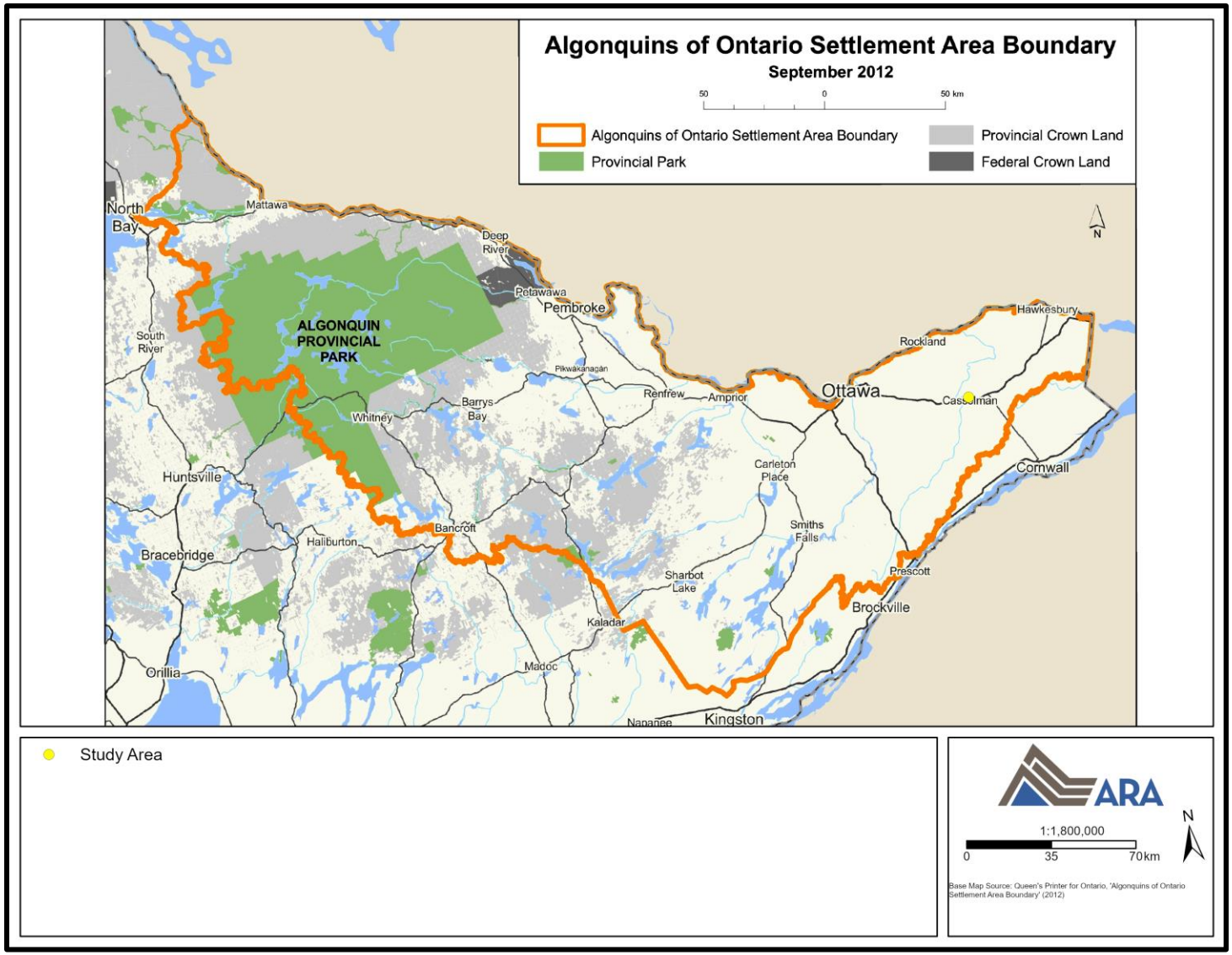
Image 23: Cemetery on J. Brisson's Farm
(June 15, 2024; Facing East)

Image 24: Cemetery on J. Brisson's Farm
(June 15, 2024; Facing Southeast)

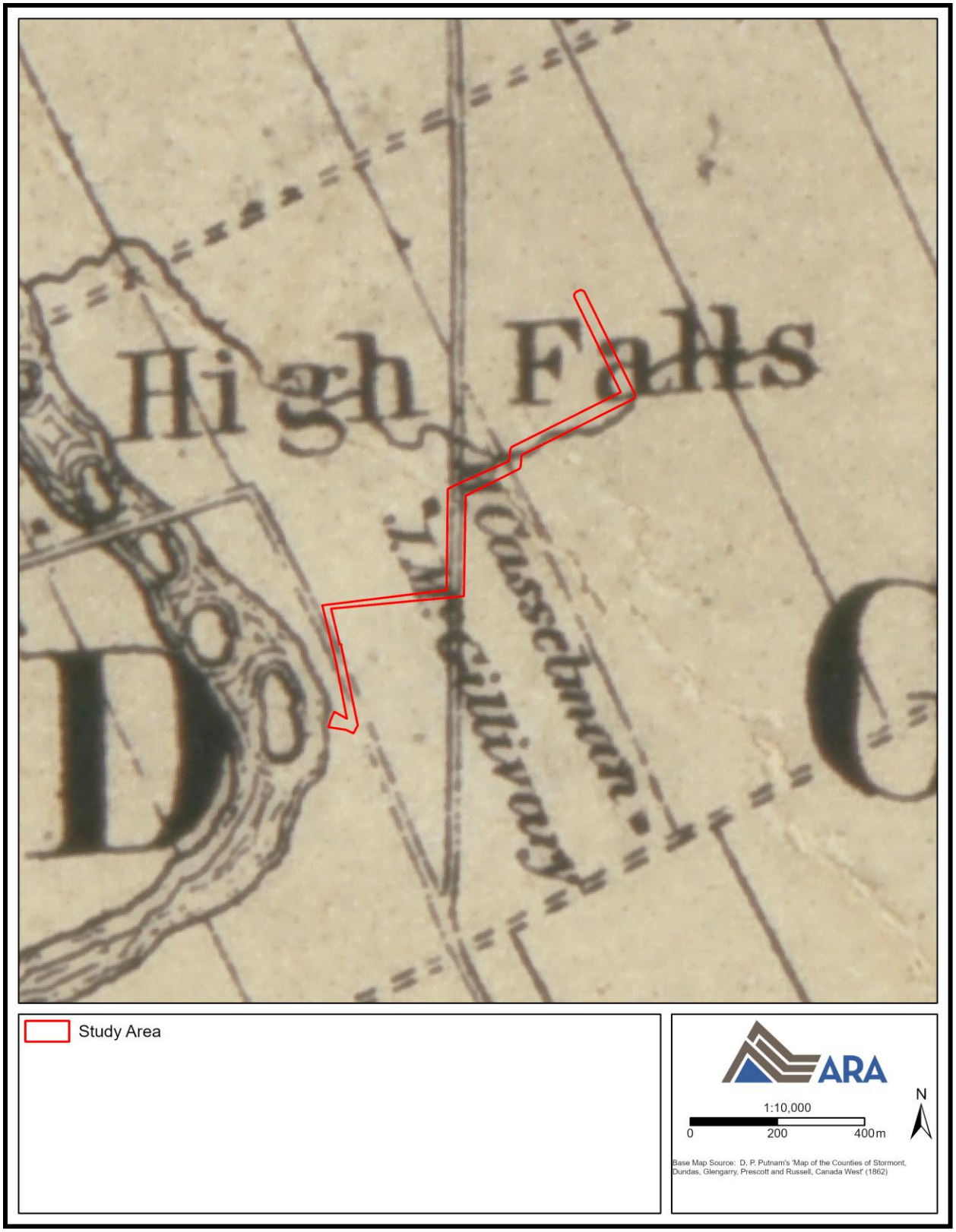
6.0 MAPS



Map 1: Location of the Study Area
(Produced under licence using ArcGIS® software by Esri, © Esri)



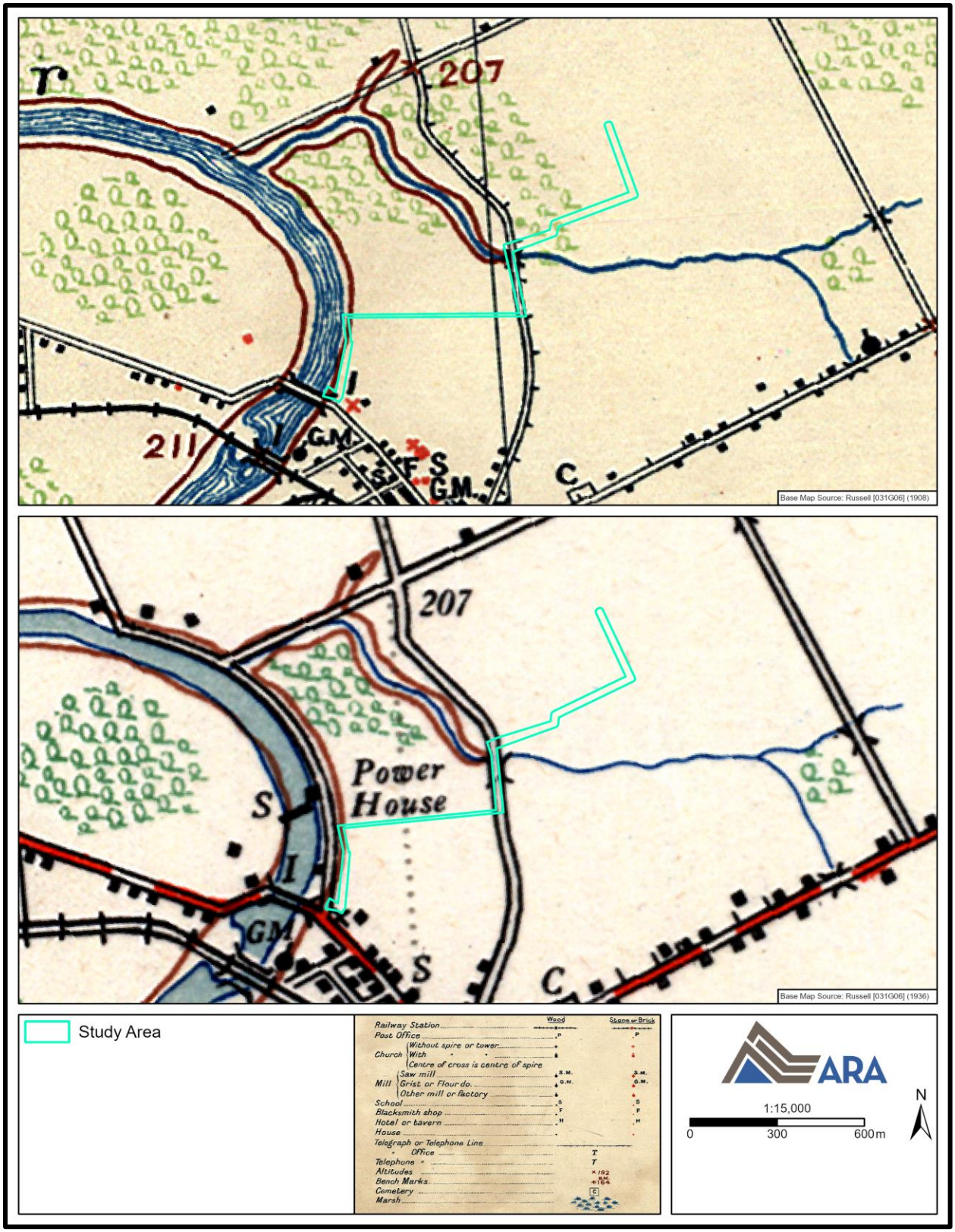
Map 2: Algonquins of Ontario Settlement Area Boundary
(Produced under licence using ArcGIS® software by Esri, © Esri; MIA 2024)



Map 3: ***Map of the Counties of Stormont, Dundas, Glengarry, Prescott and Russell*** **(1862)**

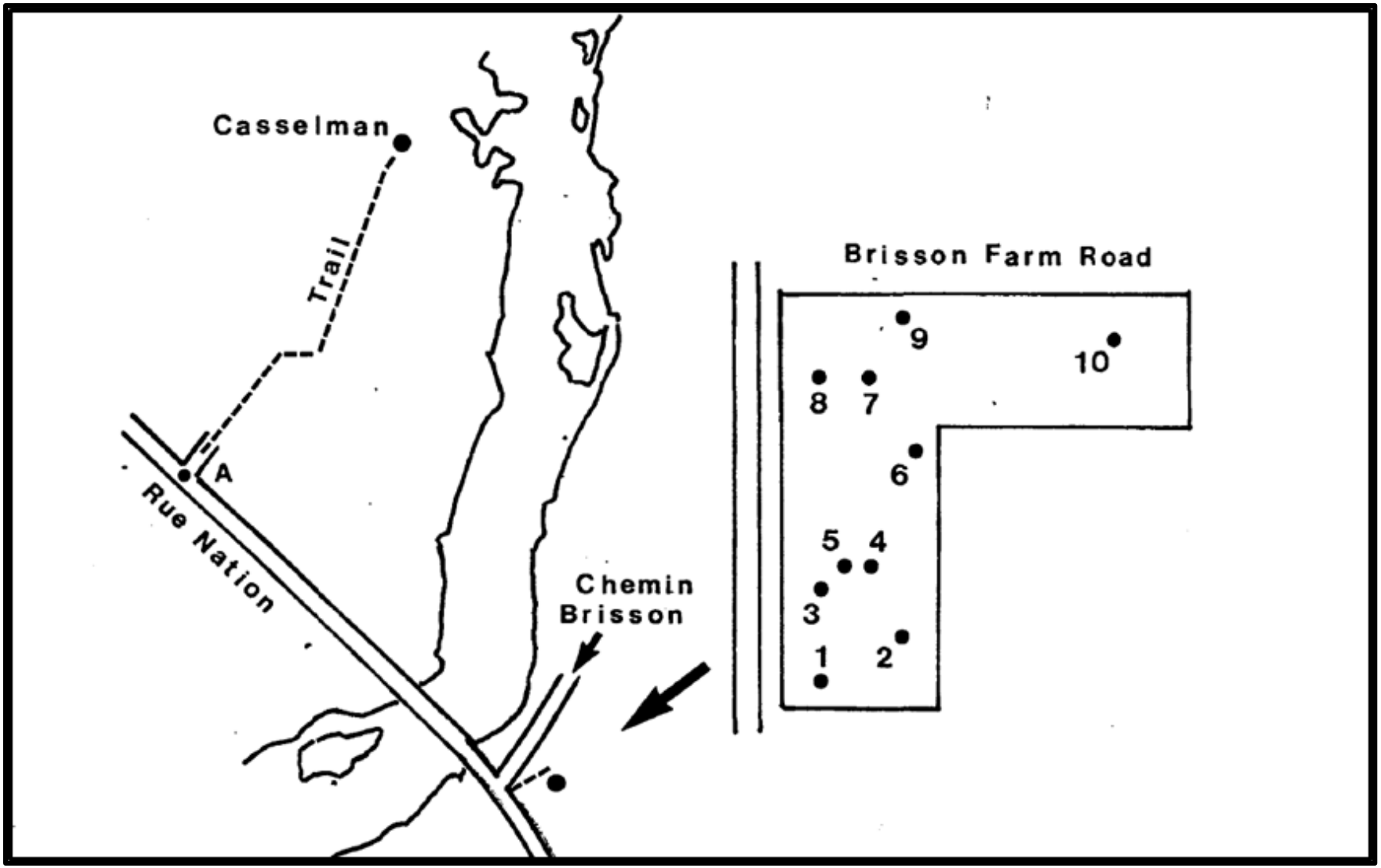
(Produced under licence using ArcGIS® software by Esri, © Esri; OHCMP 2019)

Map 4: *Prescott and Russell Supplement in the Illustrated Atlas* (1881)
(Produced under licence using ArcGIS® software by Esri, © Esri; MU 2001)

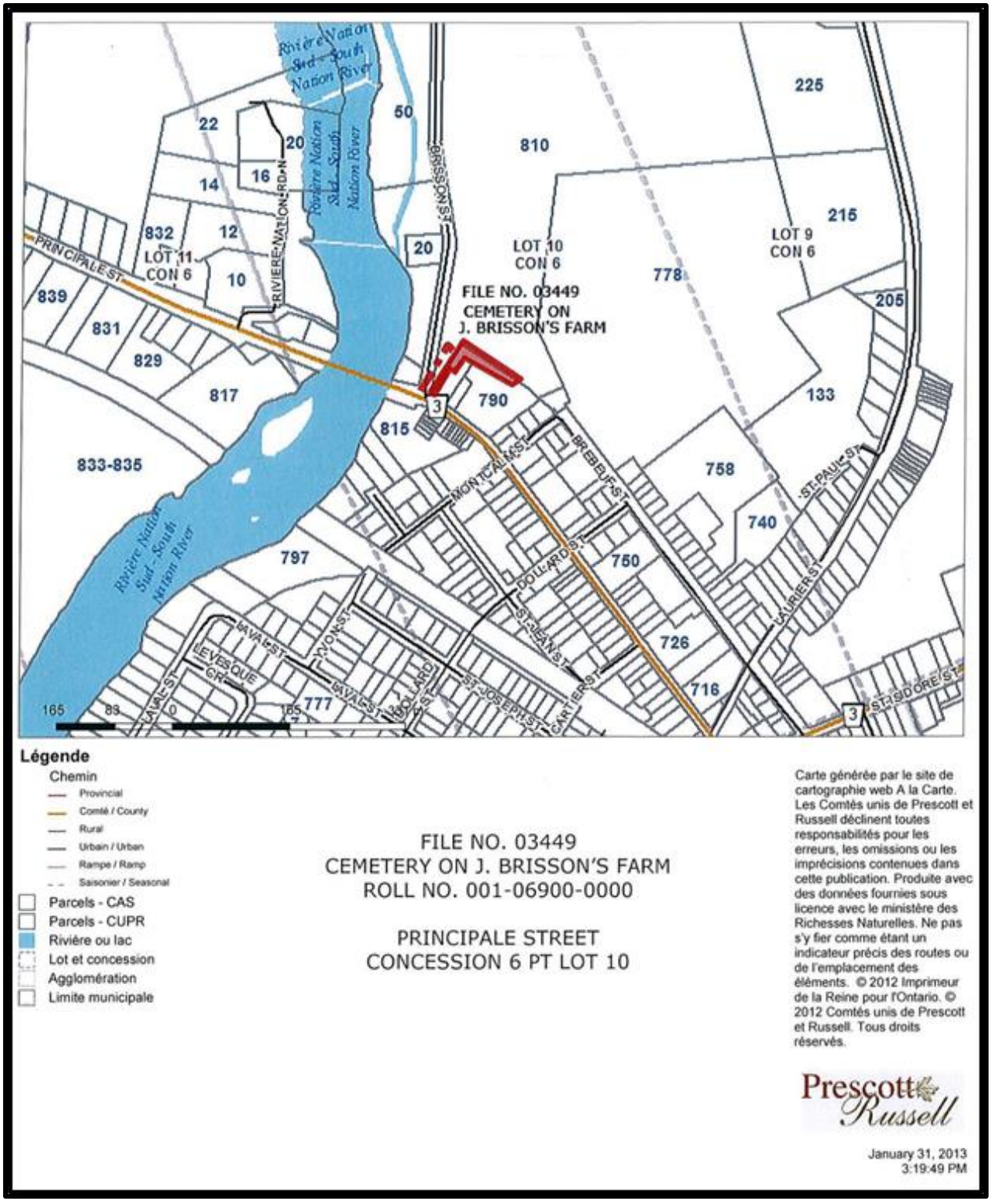


Map 5: Topographic Maps (1908 and 1936)
(Produced under licence using ArcGIS® software by Esri, © Esri; OCUL 2024)

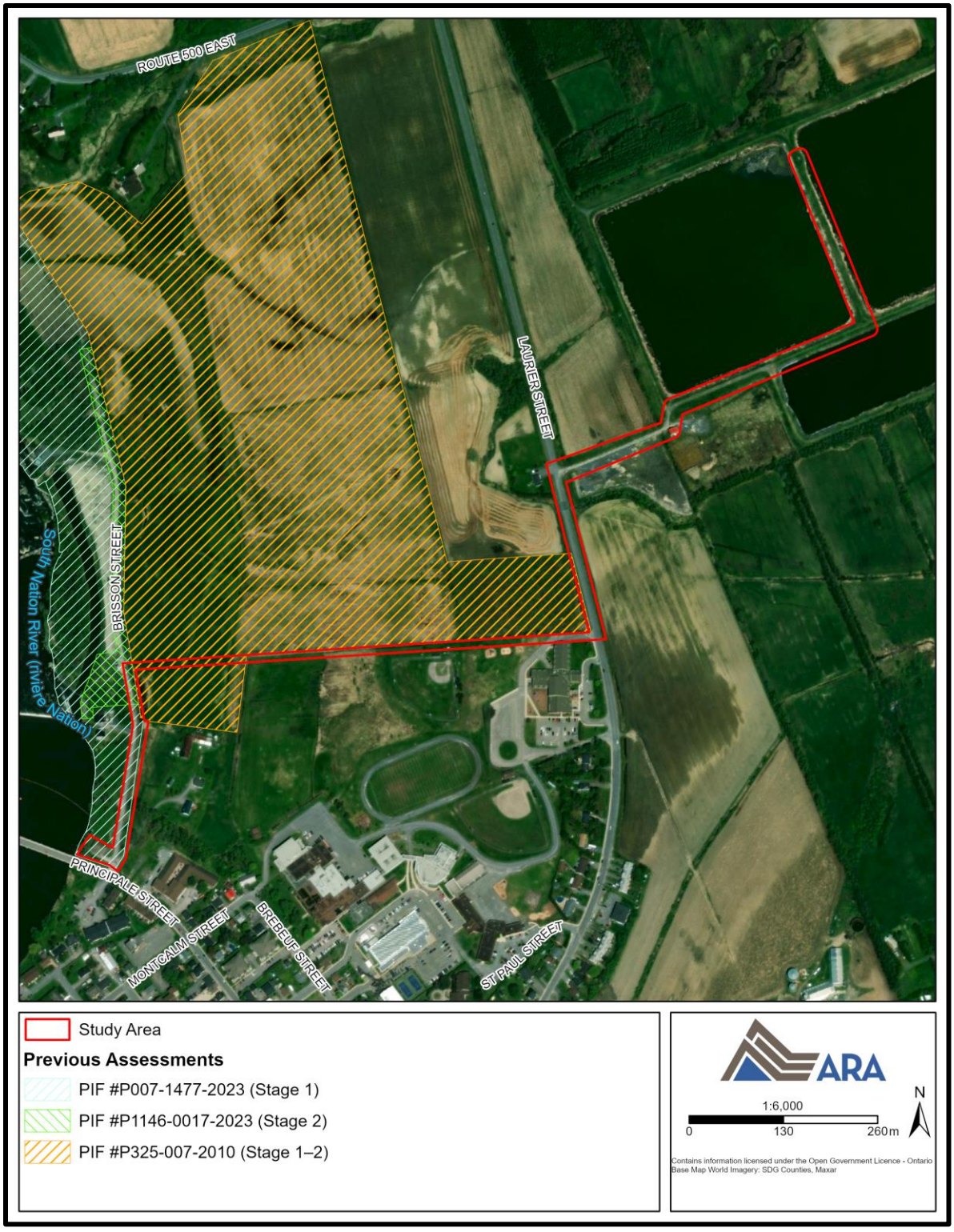
Map 6: Aerial Image (1954)
(Produced under licence using ArcGIS® software by Esri, © Esri; U of T 2024)



Map 7: Cemetery on J. Brisson's Farm (Sketch Map)
(OGS 2021:1)



Map 8: Cemetery on J. Brisson's Farm (Legal Property)
(Courtesy of Municipality of Casselman)



Map 9: Previous Assessments
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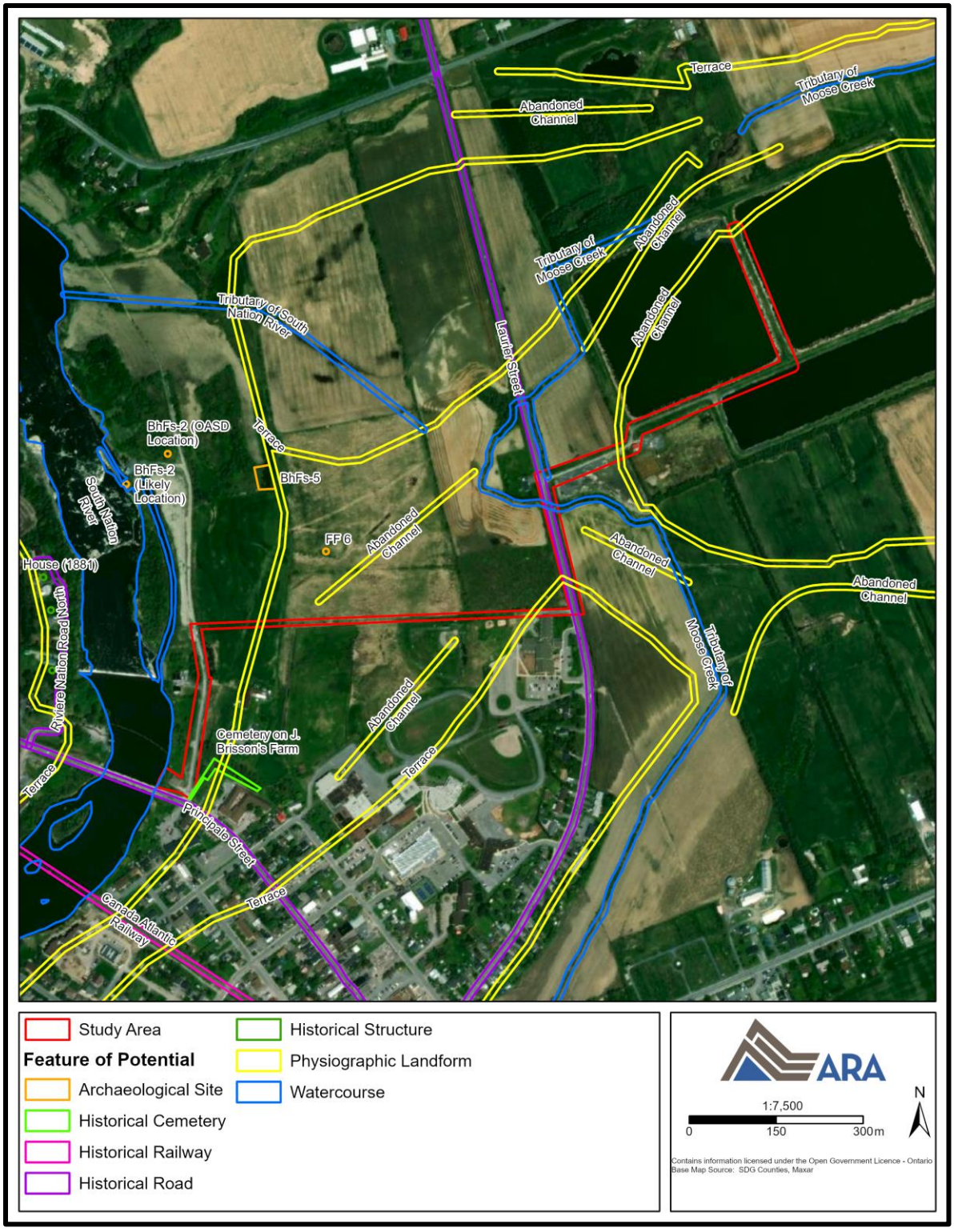

Map 10: Features of Potential
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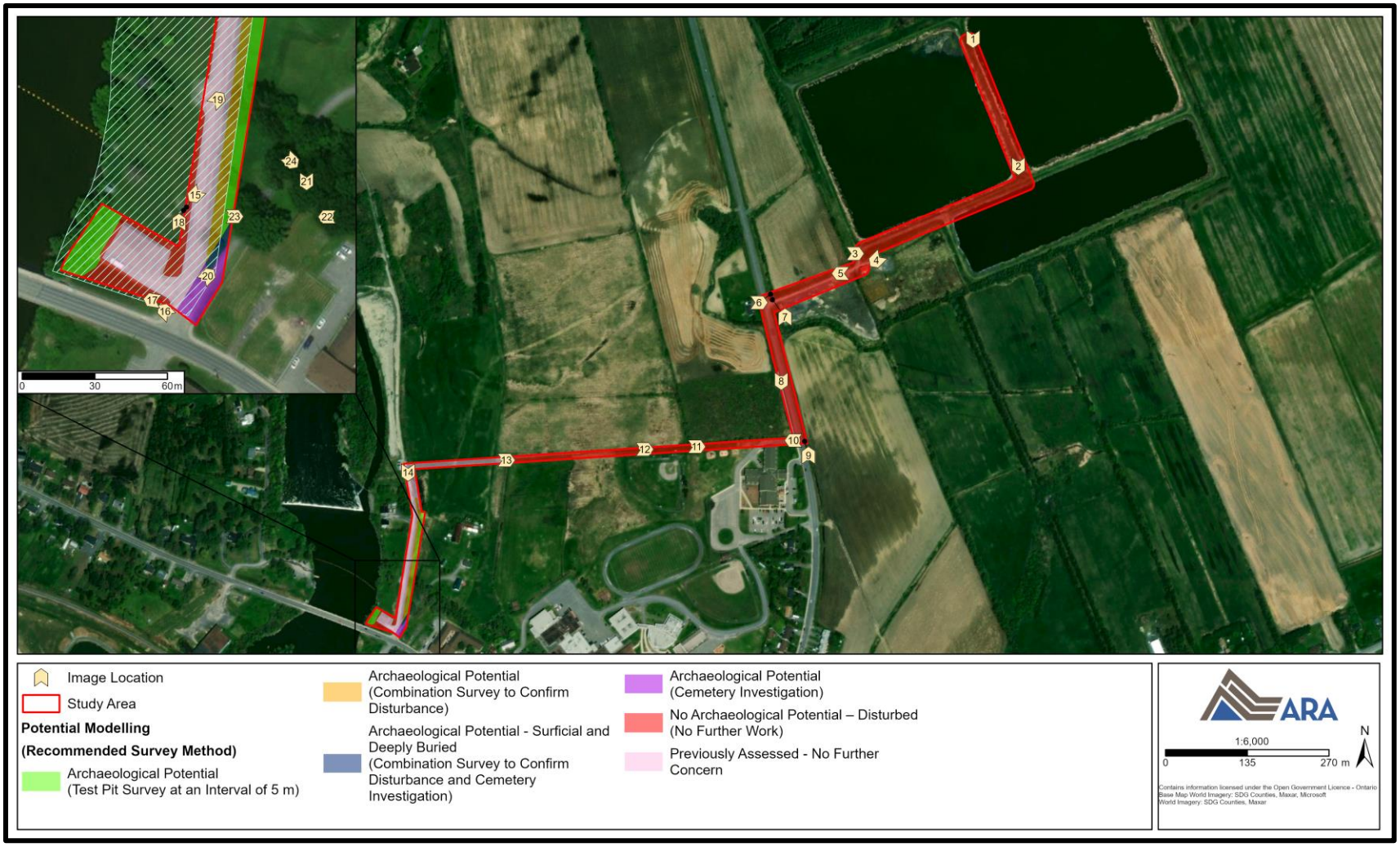

Map 11: Potential Modelling and Recommendations
(Produced under licence using ArcGIS® software by Esri, © Esri

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APPENDICES

Appendix A: Construction of SPS (2005)
(Courtesy of J. L Richards)

Image A-1: Construction of SPS
(August 1, 2005; Facing Southwest)

Image A-2: Construction of SPS
(August 1, 2005; Facing West)

Image A-3: Construction of SPS
(August 1, 2005; Facing Northeast)

Image A-4: Construction of SPS
(August 1, 2005; Facing Northwest)

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(August 1, 2005; Facing Southwest)

Image A-6: Construction of SPS
(August 1, 2005; Facing Southeast)

Image A-7: Construction of SPS
(August 1, 2005; Facing Southeast)

Image A-8: Construction of SPS
(August 1, 2005; Facing Northeast)

Appendix B: Forcemain Installation, north of Sainte-Euphémie Catholic Elementary School (2006)

(Courtesy of J. L Richards)

Image B-1: Forcemain Installation – Pre-Construction
(October 31, 2006; Facing Northwest)

Image B-2: Forcemain Installation – During Construction
(December 13, 2006; Facing Northwest)

Image B-3: Forcemain Installation – During Construction
(December 13, 2006; Facing West)

Image B-4: Forcemain Installation – Post-Construction
(August 28, 2007; Facing West)

Appendix C: Manhole Replacement (2007)
(Courtesy of J. L Richards)

Image C-1: Manhole Replacement
(June 19, 2007; Facing Southeast)

Image C-2: Manhole Replacement
(June 19, 2007; Facing Southeast)

Casselman Main Sewage Pumping Station Upgrade

Corporation of the Village of Casselman

Attachment 2 – Stage 2 Archaeological Assessment

ARCHAEOLOGY | HERITAGE | OUTREACH | CONSERVATION

DRAFT

Stage 1 and 2 Archaeological Assessments
Casselman Main SPS Upgrades
Municipality of Casselman and
Municipality of The Nation
Lots 8-10, Concession 6
Geographic Township of Cambridge
United Counties of Prescott and Russell
Former Russell County

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Licensed under
Craig Ramsoomair
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PIFs # P1106-0064-2024 (Stage 2),
#P1106-0066-2025 (Stage 1)
ARA File #2024-0528

04/04/2025

Original Report

EXECUTIVE SUMMARY

Under a contract awarded in November 2024, Archaeological Research Associates Ltd. carried out Stage 1 and 2 assessments of lands pertaining to the upgrades for the Main Sewage Pumping Station (SPS) located within the Municipality of Casselman, United Counties of Prescott and Russell. The assessment was carried out in support of detail design and the Archaeological Screening Process for Municipal Class Environmental Assessments in accordance with the *Environmental Assessment Act.* The project includes the installation of a third pump at the existing Main SPS and a new forcemain beside the existing line to meet project design flows. This report documents the background research and potential modelling involved in the investigation and presents conclusions and recommendations pertaining to archaeological concerns.

The Stage 1 and 2 assessments were conducted on November 28, 2024 under Project Information Forms (PIF) #P1106-0064-2024 (Stage 2) and #P1106-0066-2025 (Stage 1). The investigation encompassed the entire study area. Legal permission was granted to ARA by the proponent to access the subject property. At the time of the assessment, the study area consisted of existing paved and gravel roads, hay pasture and agricultural land, manicured grass, the Main Sewage Pumping Station, raised berms associated with manmade ponds, and existing infrastructure and buried utilities.

The Stage 1 assessment determined that the study area comprised a mixture of areas of archaeological potential, and areas of no archaeological potential. The Stage 2 assessment did not result in the identification of any archaeological materials. It is recommended that no further assessment be required within the property. Potential for deeply buried human remains and/or burial features remains in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) in the southeast and a cemetery investigation must be carried out to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO.

The current study area does not include the South Nation River but is adjacent. Should any in-water work be planned within the waterway, the Criteria for Evaluating Marine Archaeological Potential checklist should be consulted.

The possibility always remains some archaeological resources or relevant information may be missed following an archaeological assessment. Should previously undocumented archaeological resources or ancestral remains be discovered during the development process, the proponent or person discovering the archaeological resources must cease alteration of the site immediately, contact a licensed consultant archaeologist, and notify the following Indigenous communities:

- Algonquins of Ontario Consultation Office
    - 31 Riverside Drive, Suite 101, Pembroke, Ontario K8A 8R6; Tel: (613) 735-3759; Fax: (613) 735-6307; Email: algonquins@tanakiwin.com;
- Algonquins of Pikwàkanagàn
    - Tel: (613) 625-4010; Email: Consultation@pikwakanagan.ca; Please see Appendix A for AOPFN's Chance Find Protocol;

- Huron-Wendat Nation
    - 255, place Chef Michel Laveau, Wendake (QC), G0A 4V0; Tel: (418)-843-3767; Email: consultations@wendake.ca;
- Métis Nation of Ontario
    - Contact a Métis archaeologist or MNO R6CC; Email: Consultations@metisnation.org;

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ABBREVIATIONS

ARA – Archaeological Research Associates Ltd.
BAO – Bereavement Authority of Ontario
CHVI – Cultural Heritage Value or Interest
MCM – Ministry of Citizenship and Multiculturalism
PIF – Project Information Form
S&Gs – Standards and Guidelines for Consultant Archaeologists
SPS – Sewage Pumping System

PERSONNEL

Project Director: P.J. Racher (#P007)
Operations Manager: C.E. Gohm (#R187)
Engagement Advisors: M. DeVries, K. Kenel (#R1327)
Project Lead: C. Ramsoomair (#P1106)
Field Director: S. Brown (#R302)
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Cartographer: M. Johnson
Report Writer: N. Beaton (#R1394)
Editor: C. Ramsoomair

ENGAGED GROUPS

Algonquins of Ontario
Contacts: C. Todd, Consultation
Field Representative: None

Algonquins of Pikwàkanagàn
Contacts: K. Brethour
Field Representatives: None

Huron Wendat Nation
Contacts: M.-S. Gendron, D. Lesage
Field Representative: N. Sioui

Mohawk Council of Akwesasne
Contact: A. Jacobs
Field Representative: None

Métis Nation of Ontario
Contact: General Consultation
Field Representative: None

1.0 PROJECT CONTEXT

1.1 Development Context

Under a contract awarded in November 2024, Archaeological Research Associates Ltd. carried out Stage 1 and 2 assessments of lands pertaining to the upgrades for the Main Sewage Pumping Station (SPS) located within the Municipality of Casselman, United Counties of Prescott and Russell. The assessment was carried out in support of detail design and the Archaeological Screening Process for Municipal Class Environmental Assessments in accordance with the *Environmental Assessment Act.* The project includes the installation of a third pump at the existing Main SPS and a new forcemain beside the existing line to meet project design flows. This report documents the background research and potential modelling involved in the investigation and presents conclusions and recommendations pertaining to archaeological concerns.

The study area consists of an irregularly shaped parcel of land with an area of 4.29 ha (Map 1). The parcel is generally bounded by South Nation River to the west, agricultural lands to the north and east, the Town of Casselman and the J.R. Brisson Complex to the south. In legal terms, the study area falls on part of Lots 8-10, Concession 6, Geographic Township of Cambridge, Former Russell County. These lands comprise part of the territory subject to Crawford's Purchases in 1783. They also fall within the proposed Algonquins of Ontario Settlement Area, which will resolve a land claim that was submitted to Canada in 1983 and Ontario in 1985 (Map 2). This claim includes a series of Algonquin petitions dating back as far as 1772. The Algonquins were not consulted about the Crawford's Purchases and are not signatory to the treaty.

The Stage 1 and 2 assessments were conducted on November 28, 2024 under Project Information Form (PIF) #P1106-0064-2024 (Stage 2) and #P1106-0066-2025 (Stage 1). The investigation encompassed the entire study area. Legal permission was granted to ARA by the proponent to access the subject property. As set out in Section 2.0 of the 2011 *Standards and Guidelines for Consultant Archaeologists* (*S&Gs*), the investigation was carried out to achieve the following objectives:

- Provide information about geography, history and current land conditions;
- Determine whether any previous archaeological fieldwork has been completed;
- Evaluate in detail the study area's archaeological potential;
- Document all archaeological resources within the study area;
- Determine whether there are sites requiring further assessment; and
- Recommend appropriate strategies for Stage 3 assessment, if necessary

The Ministry of Citizenship and Multiculturalism (MCM) is asked to review the results and recommendations presented herein and enter the report into the Ontario Public Register of Archaeological Reports. A Record of Indigenous Engagement is included in the project report package in accordance with the requirements set out in Section 7.6.2 of the 2011 *S&Gs*.

1.2 Historical Context

After a century of archaeological work in eastern Ontario, scholarly understanding of the historical usage of the area has developed significantly but remains understudied. With occupation beginning in the Palaeo period approximately 11,000 years ago, the greater vicinity of the study area comprises a complex chronology of Indigenous and Euro-Canadian histories. Section 1.2.1 summarizes the region's settlement history, Section 1.2.2 provides the oral traditions of some of the Indigenous communities whose treaty, traditional and/or ancestral territories include the study area, and Section 1.2.3 documents past and present land uses. Four previous archaeological reports containing relevant background information were obtained during the research component of the study. These reports are summarized in Section 1.3.3, and the references (including title, author and PIF number) appear in Section 8.0.

1.2.1 Settlement History

1.2.1.1 Pre-Contact

The Pre-Contact history of the region is lengthy and rich, and a variety of Indigenous groups inhabited the landscape. Archaeologists generally divide this vibrant history into three main periods: Palaeo, Archaic and Woodland. Each of these periods comprise a range of discrete sub-periods characterized by identifiable trends in material culture and settlement patterns, which are used to interpret past lifeways. The principal characteristics of these sub-periods are summarized in Table 1.

Table 1: Pre-Contact Settlement History
(Wright 1972; Ellis and Ferris 1990; JHA 1993; Warrick 2000; ORHDC 2005; Munson and Jamieson 2013)

Sub-Period	Timeframe	Characteristics
Early Palaeo	9000–8400 BC	Small bands move into southern Ontario; Mobile hunters and gatherers; Utilization of seasonal resources and large territories; Gainey, Barnes and Crowfield traditions; Fluted points; Eastern Ontario was inundated by the Champlain Sea from about 10,000 to 8000 BC
Late Palaeo	8400–7500 BC	Holcombe, Hi-Lo and Lanceolate biface traditions; Continuing mobility; Campsite/Way-Station sites; Smaller territories are utilized; Non-fluted points; Mobile hunters/gatherers may have moved into the Ottawa Valley ca. 8000 BC
Early Archaic	7500–6000 BC	Side-Notched, Corner-Notched (Nettling, Thebes) and Bifurcate traditions; Gulf of Maine Archaic tradition sites are common; Growing diversity of stone tool types; Heavy woodworking tools appear (e.g., ground stone axes and chisels)
Middle Archaic	6000–2500 BC	Laurentian tradition; Reliance on local resources; Populations increasing; More ritual activities; Fully ground and polished tools; Net-sinkers common; Earliest copper tools; Inhabitants likely followed a seasonal round of hunting, fishing and gathering and engaged in long-distance trade for materials
Late Archaic	2500–900 BC	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; Less mobility; Use of fish-weirs; True cemeteries appear; Stone pipes emerge; Long-distance trade (marine shells and galena)
Early Woodland	900–400 BC	Meadowood tradition; Crude cord-roughened ceramics emerge; Meadowood cache blades and side-notched points; Bands of up to 35 people; Middlesex tradition attested late in the period within the St. Lawrence and Ottawa Valleys; Represented primarily by mortuary contexts; Assemblages characterized by blocked-end tubes of ground and polished stone and a variety of large, bifacially worked items (e.g., long leaf-shaped blades, long stemmed blades, etc.)

Sub-Period	Timeframe	Characteristics
Middle Woodland	400 BC–AD 600	Point Peninsula tradition; Vinette 2 ceramics appear; Small camp sites and seasonal village sites; Influences from northern Ontario and Hopewell area to the south; Hopewellian influence can be seen in continued use of burial mounds
Middle/Late Woodland Transition	AD 600–900	Gradual transition between Point Peninsula and later traditions; Princess Point tradition emerges elsewhere (i.e., in the vicinity of the Grand and Credit Rivers)
Late Woodland	AD 900–1600	Area occupied by Algonquian-speaking peoples; Traditions in this region developed alongside those of the Iroquoian-speaking Huron-Petun of southern Ontario; Ceramic styles predominantly derived from the south, but also influences from Lake Superior; Adopted smoking pipes and ossuary burials from the Huron-Petun, but tool traditions and houses were dissimilar; Engaged in frequent dog burials; Practised corn horticulture in a partial way; St. Lawrence Iroquoian and Haudenosaunee presence must also be considered; This area often fell under shared usage due to overlapping territories

During the earlier sub-periods, much of eastern Ontario was characterized by glacial lakes and/or inland seas that resulted in high-water levels that have left a sequence of relict shorelines. Archaeological sites associated with these physiographic features are often located far inland from modern shorelines; they are, therefore, of critical importance for locating early deposits. Many sites in this area are small and have limited artifact assemblages; this lack of 'site visibility' is further compounded by the expedient use of local stone for tools and the sustainability of early lifeways in general. Many scatters in this area likely represent camps, chipping stations or processing areas associated with mobile peoples, utilized during their travels along the local drainage basins while making use of seasonal resources.

This part of Ontario represents the ancestral territory of various Indigenous groups, each with their own land use and settlement pattern tendencies. The Algonquin Nation represents one such group, which comprised many bands whose familial territories were divided by rivers and whose names are often reminiscent of the traditional people of that particular river. The study area lies within the traditional territory of the Onontchataronon, also known as the people of Iroquet after one of their chiefs, who lived along the South Nation River and other lands to the west. There have been few archaeological assessments conducted in the South Nation River drainage basin to date. As a result, we do not yet have a comprehensive understanding of the past land use of the area.

Indigenous settlement within eastern Ontario was late in comparison to other parts of the province due to the presence of the Champlain Sea, which inundated the St. Lawrence Lowland following the retreat of the Laurentide Ice Sheet from about 10,000 BC to 8000 BC (Russell et al. 2011). Although no Palaeo sites were identified during an early archaeological inventory of the South Nation drainage basin, it was noted that they would most likely occur in the higher regions such as the Spencerville and Brockville areas (Daechsel 1980). It is possible that Indigenous peoples followed the changing shoreline of the Champlain Sea and moved into the area late in the period as the crust rebounded and conditions became more favourable. Examples of Late Palaeo artifacts in eastern Ontario include two lanceolate points from Lanark County and a chipped stone semi-lunar ulu from Bob's Lake in the Township of Bedford (Watson 1990, 1999). A Late Palaeo occupation has been noted on Thompson Island in the St. Lawrence River area (Ritchie 1969:18), and non-fluted lanceolate points have been found in the Thousand Islands and north of Kingston along the Cataraqui River (HQI 2000).

Eastern Ontario was actively utilized by Indigenous peoples during the subsequent Archaic period as the ice sheet continued to recede and the climate warmed. Examples of Archaic sites in the region include the Early Archaic Taite site (BjFu-4) south of Becketts Creek in the Township of Cumberland, the Late Archaic Muldoon site (BiFs-1) east of Pendleton and the Lamoureaux site (BiFs-2) along the South Nation River (Clermont 1999). Gulf of Maine Archaic tradition sites also occur, which date from ca. 7500–4000 BC, and are characterized by the bipolar reduction of quartz and the absence of bifacial reduction (Swayze and McGhee 2011).

Little evidence exists for the Early Woodland period in the vicinity of the study area, although such sites are attested to the west near Arnprior and to the south (IE 2011:4). Middle Woodland sites, on the other hand, are much better documented. Kittle Creek 1 (BgFt-3) appears to be a Middle Woodland campsite that is part of a cluster of sites east of Cannamore in the Township of Winchester, overlooking the north bank of the South Nation River. Chesterville 2 (BgFt-6), a multi-component Late Archaic and Late Woodland campsite, and the Droppo site (BgFt-7), a multi-component site with an Indigenous component of unknown date, are also part of this cluster. Crysler 1 (BhFs-3) is an Indigenous campsite of unknown date on the west bank of the Payne River in the Township of Finch. Late Woodland period sites are often associated with the Algonquin groups noted during the time of European contact, such as the Kichesipirini, Weskarini, Kinounchepirini, Matouweskarini and Onontchataronon (JHA 1993; ORHDC 2005).

1.2.1.2 Post-Contact

The arrival of European explorers and traders at the beginning of the 17th century triggered widespread shifts in Indigenous lifeways and set the stage for the ensuing Euro-Canadian settlement process. Documentation for this period is abundant, ranging from the first sketches of Upper Canada and the written accounts of early explorers to detailed township maps and lengthy histories. The Post-Contact period can be effectively discussed in terms of major historical events, and the principal characteristics associated with these events are summarized in Table 2.

Table 2: Post-Contact Settlement History
(Smith 1846; Coyne 1895; Lajeunesse 1960; Cumming 1972; Ellis and Ferris 1990; JHA 1993; Surtees 1994; ORHDC 2005; AO 2024)

Historical Event	Timeframe	Characteristics
Early Exploration	Early 17th century	Brûlé explores southern Ontario in 1610/11; Champlain travels through in 1613 and 1615/1616, making contact with a number of Indigenous groups (including the Algonquin, Huron-Wendat and other First Nations); European trade goods become increasingly common and begin to put pressure on traditional industries; Names of bands suggest that Algonquin territorial organization was based on watersheds; Nipissings and Algonquins were involved in inter-tribal trade
Increased Contact and Conflict	Mid- to late 17th century	Conflicts between various First Nations during the Beaver Wars result in numerous population shifts; Nipissings and Algonquins tended to avoid the lower Ottawa in the summer due to Iroquois attacks; European explorers continue to document the area, and many Indigenous groups trade directly with the French and English; 'The Great Peace of Montreal' treaty established between roughly 39 different First Nations and New France in 1701

Historical Event	Timeframe	Characteristics
Fur Trade Development	Early to mid-18th century	Growth and spread of the fur trade; Bands of the Algonquin Nation occupied the Ottawa Valley; Many spent their summers at mission villages; Peace between the French and English with the Treaty of Utrecht in 1713; Ethnogenesis of the Métis; Hostilities between French and British lead to the Seven Years' War in 1754; Algonquins, Huron-Wendat and Nipissing part of the Seven Nations that sided with France; French surrender in 1760; Seven Nations agreed to join the Six (formerly Five) Nations Iroquois in one large alliance in the British interest
British Control	Mid- to late 18th century	*Royal Proclamation* of 1763 recognizes the title of the First Nations to the land; Representatives from 24 First Nations attended the Niagara Treaty Council; Numerous treaties subsequently arranged by the Crown; First land cession under the new protocols is the Seneca surrender of the west side of the Niagara River in 1764; The Niagara Purchase (Treaty 381) in 1781 included this area
Loyalist Influx	Late 18th century	United Empire Loyalist influx after the American Revolutionary War (1775–1783); British develop interior communication routes and acquire additional lands; Crawford's Purchases completed in 1783 to provide land for the Loyalists; *Constitutional Act* of 1791 creates Upper and Lower Canada
County Development	Late 18th to early 19th century	Became part of Stormont County in 1792; Russell County established in 1798; Comprised the Townships of Cambridge, Clarence, Cumberland, Gloucester, Osgoode and Russell; Gloucester and Osgoode added to Carleton County in 1838; Initial settlement was slow; Part of the United Counties of Prescott and Russell in 1820; Independent after the abolition of the district system in 1849
Township Formation	Late 18th to mid-19th century	Surveyed by J. Rankin in 1791; First grants went to United Empire Loyalists, including Col. Rankin, Col. Brewerton and the Jessup brothers; Additional survey work conducted by W. Browne in 1822 and D. McDonell in 1834; M. Casselman explored the area and built a hut on the South Nation River in the early 1830s; D. McGillis and Mr. Kennedy were the only documented residents in 1837; Roughly half of the township was held by non-resident, ex-officers
Township Development	Mid-19th to early 20th century	Population reached 102 by 1842; M. Casselman settled near High Falls in 1844, and the McRae, McKinnon and Ferguson families arrived thereafter; 1,165 ha taken up by 1846, with 65 ha under cultivation; 1 saw mill in operation at that time; By 1881, most of the inhabitants were of French Canadian origin; Traversed by the Canada Atlantic Railway (1882) and Ottawa & New York Railway (1898); Communities at Casselman, Grant, Mayerville and St. Albert

Many Algonquins living in this region were Christians but also belonged to traditional bands occupying various watersheds. Traditional band members lived within their hunting grounds for most of the year (ORHDC 2005). Numerous petitions were made to the Crown regarding lands and rights, the earliest of which dates from 1772 and describes the extent of Algonquin and Nipissing territory as encompassing both sides of the Ottawa River from Long Sault to Lake Nipissing (JHA 1993). As Euro-Canadian settlement progressed, Algonquin and Nipissing bands began to press for reserve lands within their own traditional territories (JHA 1993; ORHDC 2005).

In 1798, Algonquin and Nipissing leaders appealed to the Crown to restrict European settlement along the Ottawa River. The Algonquin and Nipissing leaders did not receive a response to their letter, and instead, the lands were further opened for settlement following the conclusion of the War of 1812 and Loyalist land grants in Lanark and Frontenac Counties. Algonquin leaders continued to petition the Crown to acknowledge that the Ottawa Valley lands were Algonquin lands. The government, however, wanted to grant agricultural lands rather than allow the Algonquin lands to remain as hunting grounds. In 1842, Chief Pierre Shawanepinesi petitioned for a tract of 2,000 acres covering parts of the Townships of Oso, Bedford and South Sherbrooke. In 1844, the petition was granted by Order in Council for the 2,000 acres to be set aside under a licence of occupation. The granted lands of the Bedford Reserve continued to be impacted by logging and trespassing of settlers. Chief Shawanepinesi petitioned the government regarding

logging and squatters at the Bedford Reserve between 1845 and 1861. Many of the residents of the Bedford Reserve had returned to Kanesatake during this period or moved to Kitigan Zibi, Ardoch and Pikwàkanagàn. By 1861, the Superintendent of Indian Affairs denied the existence of the Bedford Reserve. Even Shawanepinesi left the Bedford Reserve, and by 1881, he had relocated to Pikwàkanagàn (JHA 1993; Bostock and Nelson 2019; Morrison n.d.: 31).

1.2.2 Oral Traditions

The study area occupies lands that fall within the treaty, traditional and/or ancestral territories of numerous First Nations. Indeed, this area was used and shared by many Indigenous groups over the millennia; each with their own traditions as to how they arrived, how they lived, and the major events that punctuated their time there. Amongst these communities, the Algonquins of Ontario also have an oral tradition, presented in the Seven Fire Prophecy wampum belt and the Huron-Wendat were able to provide their own traditional oral historical narrative. These oral histories are reproduced in Table 3–Table 4 (ordered alphabetically). It is hoped that other such accounts can be incorporated into studies like this as they become available. It should be noted that a given oral history does not necessarily reflect the views of other groups or the consultant archaeologist.

Table 3: Algonquins of Ontario Oral History
(Benton-Banai 1979:94–102)

Seven Fire Prophecy
The prophets of the Seven Fires came to the Anishinabe nation when they were residing on the east coast of North America. The visit from the prophets prompted the western migration of the Anishinabe from the east coast, with the Wa-bun-u-keeg' or Daybreak People remaining behind to maintain the eastern fire at the eastern doorway. It is thought that these people were who the French called Abnaki. The prophet of the First Fire encouraged the migration to the west prior to the arrival of European settlers, advising that, "If you do not move, you will be destroyed." The prophet of the First Fire, as recounted by the Mide people, spoke of the first of seven stopping places during the journey west. The first stopping place was a turtle shaped island, the directions to which were thought to be coming from the Creator. A pregnant woman dreamt that she was standing on the back of a turtle in the water, with the turtle's head pointing west and tail pointing east. The dream was accepted by elders and the people were instructed to explore the rivers for the location of the island. The island was found in the St. Lawrence River and it is thought today that it was located at the confluence of the St. Francis River and the St. Lawrence River northeast of Montreal. The second major stopping place on the westward journey was at Ani-mi-kee' wa-bu (Niagara Falls), where the people were greeted by a Sacred Megis Shell (cowrie) that came out of the water. The Sacred Fire was moved to this second major stopping place for a period of time. The third stopping place was described by the prophets as "a place where two great bodies of water are connected by a thin, narrow river." This stopping place was likely along the shores of the Detroit River where it connects to Lake St. Clair, with Lake Huron to the north and Lake Erie to the south. The Sacred Megis is said to have appeared out of the water again to greet the people. It was at this stopping place that the Anishinabe met Haudenosaunee warriors. The Haudenosaunee were pursuing the Anishinabe but later gave them a wampum belt and the pipe of peace was shared. At this time, three groups emerged: the Ish-ko-day'-wa-tomi (fire people, keepers of the Sacred Fire) who are known later as the Potawatomi; the O-daw-wahg' (trader people, providers of food for the nation and in charge of major hunting expeditions) who are known as the Ottawa; and the Ojibway (faith keepers of the nation entrusted with keeping the Sacred Scrolls and the Waterdrum of the Midewiwin) who have sometimes been referred to as Chippewa. The three groups became known as the nation of the Three Fires. Along the way to the fourth stopping place, the nation of Three Fires were attacked by the Sauks and Foxes before they stopped to camp along what is believed to have been the eastern shore of Lake Michigan. Villages were established at the camp while ways to cross the lake were considered and many felt that the group had become lost and had missed the fourth stopping place. During this time, teachings of the Midewiwin Lodge were beginning to be abandoned and Spirit Ceremony and Sweat Lodge waned. Some elders were able to maintain the Sacred Fire. The prophecies said that, "a boy would be born to show the Anishinabe back to the sacred ways." The boy came and dreamt of stones that led across the water and the Mide people led the people back to the Detroit River where they rested on Walpole Island. They then moved northward along the

Seven Fire Prophecy
eastern shore of Lake Huron before reaching Manitoulin Island, the fourth major stopping place. The Sacred Megis appeared on the island and the people returned to the Midewiwin Way. It was at this time that the Clan System was established. The migrating group is said to have stayed at Manitoulin Island for a period of time before moving to Baw-wa-ting' (Sault Ste. Marie) where the people again were greeted by the Megis Shell. Baw-wa-ting' became the fifth major stopping place and was abundant in fish to support the people. From Ba-wa-ting', the migration split into two groups, with one group continuing westward and the other group northward. Both groups encountered the Ba-wahn', later known as Dakotas, whose hunting territory was invaded with the arrival of the Anishinabe. The sixth major stopping place was at Spirit Island at the west end of Lake Superior where the Sacred Shell appeared to the northern group. The words of the prophets were fulfilled at Spirit Island as the Anishinabe found Ma-no'-min (wild rice), "the food that grows on water." The prophets had spoken of a turtle-shaped island that awaited the group at the end of their migration. The southern group saw an island that was located beyond a long point of land that fit the description of the island that they were looking for. The people went to the island and placed tobacco on the shore and were greeted by the Sacred Shell. The Sacred Shell told the people that they had arrived at their last stop of the migration. The seventh and final stop was at Mo-ning-wun'-a-kawn-ing (later called Madeline Island) and the Sacred Fire burned brightly there. It is thought that the migration began in 900 A.D. and took about 500 years to complete, all the while with the Sacred Fire being kept alive.

Table 4: Huron-Wendat Nation Oral History
(Provided by Huron-Wendat First Nation)

Huron-Wendat First Nation Historical/Background context
As an ancient people, traditionally, the Huron-Wendat, a great Iroquoian civilization of farmers and fishermen-hunter-gatherers and also the masters of trade and diplomacy, represented several thousand individuals. They lived in a territory stretching from the Gaspé Peninsula in the Gulf of Saint Lawrence and up along the Saint Lawrence Valley on both sides of the Saint Lawrence River all the way to the Great Lakes. Huronia, included in Wendake South, represents a part of the ancestral territory of the Huron-Wendat Nation in Ontario. It extends from Lake Nipissing in the North to Lake Ontario in the South and Île-Perrot in the East to around Owen Sound in the West. This territory is today marked by several hundred archaeological sites, listed to date, testifying to this strong occupation of the territory by the Nation. It is an invaluable heritage for the Huron-Wendat Nation and the largest archaeological heritage related to a First Nation in Canada. According to our own traditions and customs, the Huron-Wendat are intimately linked to the Saint Lawrence River and its estuary, which is the main route of its activities and way of life. The Huron-Wendat formed alliances and traded goods with other First Nations among the networks that stretched across the continent. Today, the population of the Huron-Wendat Nation is composed of more than 4000 members distributed on-reserve and off-reserve. The Huron-Wendat Nation band council (CNHW) is headquartered in Wendake, the oldest First Nations community in Canada, located on the outskirts of Quebec City (20 km north of the city) on the banks of the Saint Charles River. There is only one Huron-Wendat community, whose ancestral territory is called the Nionwentsïo, which translates to "our beautiful land" in the Wendat language. The Huron-Wendat Nation is also the only authority that have the authority and rights to protect and take care of her ancestral sites in Wendake South.

1.2.3 Past and Present Land Use

During Pre-Contact and Early Contact times, the vicinity of the study area would have comprised a mixture of coniferous trees, deciduous trees and open areas. Indigenous communities actively utilized the land and its resources well into Post-Contact times, and they would have managed the landscape to varying degrees (e.g., establishing clearings for campsites, plant cultivation, etc.). Given that Anishinaabeg populations lived lightly on the land and practised sustainable lifeways, this level of management would have been relatively limited. During the late 18th to early 19th

centuries, Euro-Canadian settlers arrived in the area and began to clear the forests for lumbering, agricultural and settlement purposes. The study area was located partly within the historical limits of the Municipality of Casselman.

Examinations of early mapping and aerial imagery were carried out to provide a general framework for reconstructing the history of the Euro-Canadian settlement in the study area. Detailed documentary research of the land use and occupation history specific to the Brisson J. Farm Cemetery (CM-2003171) was also conducted, which involved the consultation of land registry records and additional information sources as set out in Section 3.1 of the 2011 *S&Gs*. The land use at the time of assessment can be classified as a mixture of residential, infrastructural and agricultural.

1.2.3.1 Casselman

The origin of the community of Casselman can be traced to the arrival of Martin Casselman and his subsequent development projects. Casselman, a Loyalist descendant, visited the area in 1832 and decided to establish a village to exploit the abundant lumber resources. In 1843, he purchased 1,600 acres on either side of the river from the Jessup family. Casselman settled near a waterfall on the banks of the river in 1844 and established a dam and sawmill. He was assisted by 40 men, each of whom was promised a parcel of land at a very low price in exchange. The Canada Atlantic Railway arrived in 1882, and a series of devastating fires occurred between 1891 and 1919. In 1891, a fire destroyed the Casselman Lumber Co. and part of the village, and in 1897, a second fire destroyed nearly the entire settlement. In 1919, a third fire destroyed many buildings along the main street, although the church, bank and a store were saved by firemen from Ottawa (MC 2024).

1.2.3.2 Coupal and Laplante Hydroelectric Stations

In 1908, a local businessman named J. N. Coupal began construction on a 140 m (460') dam across the South Nation River and an associated 125 kW powerhouse to provide electricity for his home, grist mill and neighbouring homes. The project was completed in 1910, and the village council granted a 30-year franchise to Coupal to supply electricity to the rest of the village. Coupal closed his grist mill in 1922, increasing the supply to the village as a result. By this time, demand had increased significantly, and some new residents were on two-year waiting lists to receive power. A local power commission was formed in 1924, and a new 10-year contract was negotiated to supply power, part of which required that all surplus money be refunded to customers. The village resumed the terms of the 30-year contract after the 10-year contract expired. By 1952, the demand for electricity had increased beyond the capacity of Coupal's system and the village established a publicly managed utility called Casselman Hydro (CG 2024; HO 2024).

Coupal's plant ceased operations in the mid-1960s. In 1986, a new hydroelectric station was constructed by G. Laplante to provide power to roughly 75 customers in Casselman. This involved the blasting and excavation of a 5 m wide trench along the side of the river and the construction of a powerhouse only a few metres from Coupal's powerhouse (Levere 1986). Casselman Hydro became part of the Hydro Ottawa family in May 2002 (HO 2024). Laplante's powerhouse was still in operation at the time of assessment, and the ruins of the Coupal plant are visible to the south.

1.2.3.3 Doran Park

Doran Park is located on the east bank of the South Nation River and is part of the High Falls Conservation Area (formerly known as the Casselman Conservation Reservoir). The conservation area itself spans both banks of the South Nation River (south of the weir built in 1966) and consists of 5.5 acres of parkland with barbeques, picnic facilities, a floating dock, a boat launch and other amenities. The area is well known for walleye and pike fishing, and fishing derbies are common. The ruins of J.N. Coupal's dam from 1910 are visible from the boundaries of the park (SNC 2020).

1.2.3.4 Mapping and Imagery Analysis

In order to gain a general understanding of the study area's past land uses, two historical settlement maps, two topographic maps, one aerial image, one settlement map were examined during the research component of the study. Specifically, the following resources were consulted:

- *Map of the Counties of Stormont, Dundas, Glengarry, Prescott and Russell, Canada West* (1862) (OHCMP 2019);
- *Prescott and Russell Supplement in the Illustrated Atlas of the Dominion of Canada* (1881) (MU 2001);
- Topographic maps from 1908 and 1936 (OCUL 2025);
- Sketch map of Brisson J. Farm Cemetery (OGS 2021:1); and
- An aerial image from 1954 (U of T 2024);

The limits of the study area are shown on georeferenced versions of the consulted historical resources in Map 3–Map 6 with mapping related to the Brisson J. Farm Cemetery in Map 7 and Map 8.

The *Map of the Counties of Stormont, Dundas, Glengarry, Prescott and Russell, Canada West* (1862) provides little information concerning past land uses (Map 3). Lot 9, Concession 6 was occupied by M. Casselman and J. McGillivary while no occupants are listed for the other lots. This publication only included information for its subscribers, however, so this is not necessarily an indication that the subject lands were vacant or otherwise unimproved. The study area occupied lands east of the South Nation River. The area is identified as High Falls, and several islands are shown within the river. Martin Casselman's mill appears on the opposite bank and a tributary of the South Nation River traversed the northern part of the study area. The schematic layout of present-day Laurier Street and Brisson Street are illustrated as traversing the study area.

The *Prescott and Russell Supplement in Illustrated Atlas of the Dominion of Canada* (1881) identifies Casselman as well as High Falls but does not reveal any occupants within the study area (Map 4). Among the structures present, Martin Casselman's mill and the Casselman Post Office can be seen depicted on the west bank of the South Nation River. The schematic layout of present-day Principale Street and Laurier Street are illustrated while Brisson Street is now absent.

The topographic maps from 1908 and 1936 illustrate the development of the study area (Map 5). Both depict a brick church and an adjacent building to the southeast of the study area while the northeastern part of the subject lands comprised either cleared or wooded lands traversed by present-day Laurier Street and a tributary of the South Nation River. The 1938 map illustrated the notable development of Coupal's Dam and Powerhouse, built in 1908. It is accompanied by the

inclusion of present-day Brisson Street and a frame house. Casselman proper appears to have changed little between 1906 and 1938. The aerial image from 1954 largely confirms this land use pattern, with the northern part of the study area being used for agriculture (Map 6). The dam and powerhouse are clearly visible, as is the earlier residence along Brisson Street. Although the resolution is poor, some of the lands between the powerhouse and Brisson Street appear to have been impacted.

The current SPS was built in 2005, replacing a prior and smaller structure. The current force main was installed in 2006, and an additional manhole adjacent to the SPS was constructed in 2007. Photos documenting the construction of the SPS were provided in the Stage 1 archaeological assessment (ARA n.d.).

1.2.3.5 Brisson J. Farm Cemetery (CM-2003171)

The Brisson J. Farm Cemetery (CM-2003171) comprises an unaddressed L-shaped property located between 806 and 810 Principale Street (Nation View Farm). The visible grave markers fall on the southeast side of the driveway leading to Nation View Farm. The cemetery has several alternate names, including Cemetery on J. Brisson's farm, J. Brisson's Farm Cemetery, Doran Farm Road Cemetery, Presbyterian Cemetery, Abandoned Cemetery and Brisson Farm Road Cemetery (OGS 2023). The name used by the Bereavement Authority of Ontario (BAO) has been adopted herein (BAO 2017). The principal transactions documented in the land registry records for this property are summarized in Table 5. A full discussion of the results of the additional historical documentation appears below.

Table 5: Land Transaction Summary
(LRO #50)

Instrument Number	Instrument	Date	Grantor	Grantee	Comments
-	Patent	24 Aug 1796	Crown	Edward Jessup	200 acres
10542	Will	3 Nov 1815	Edward Jessup	-	-
2066	Deed	17 Jul 1835	Susannah Jessup	Hamilton D. Jessup	200 acres
2067	Deed	17 Jul 1835	Hamilton D. Jessup	James Jessup	200 acres
3746	Deed	14 Mar 1843	James Jessup	Martin Casselman	200 acres
1481	Will	20 Aug 1884	Martin Casselman	John S., Martin M. and Ralph A, Casselman	200 acres
12	Plan	18 Dec 1884	H.O. Wood, PLS	R.A. Casselman	-
2975	Deed	21 Jul 1885	Martin M. Casselman and wife	Trustees of the Presbyterian Church	2 acres, 2 roods, 1 perch; Part of Lot EC, Plan of South Casselman
17542	Grant	4 Nov 1944	Trustees of Casselman United Church	David Preston Valley	Part of Lot excepting the cemetery parcel.

The Crown Patent for Lot 10, Concession 6 (200 acres) went to Edward Jessup in August 1796. Jessup was a Loyalist and military member, serving for a time with the King's Royal Regiment of

New York and later as captain of the King's Loyal Americans corps before joining Governor Haldimand as major commandant of the Loyal Rangers, later known as Jessup's Rangers (Bowler 1983; Bruin 2023). Following the American Revolutionary War, Jessup and his family moved to Quebec, and Jessup became a land speculator in both Quebec (Lower Canada) and Ontario (Upper Canada). Some of Jessup's land holdings included 3,800 acres on the South Nation River, comprising part of the study area (Bowler 1983). It remains unclear if Jessup's lands within the Township of Cambridge were ever improved during his period of ownership. Jessup and his son founded the Town of Prescott in 1810 (Bowler 1983). Edward Jessup died in 1816, and his lands on Lot 10, Concession 6 were ultimately transferred to James Jessup in 1835.

James Jessup sold the 200-acre lot to Martin Casselman in 1843. Martin Casselman purchased 1,600 acres flanking the South Nation River and settled near the waterfall where he later established a dam and sawmill (MC 2023). Following Casselman's death, Lot 10, Concession 6 (200 acres) was transferred to his sons John, Martin and Ralph in December 1884. In 1885, Ralph Casselman had a plan of survey prepared by H. O. Wood, Provincial Land Surveyor, to subdivide parts of Lots 10 and 11, Concession 6. This was known as the *Plan of South Casselman* (Plan 12), and the study area was located to the east of the subdivided area (LRO #50). In 1885, Martin Casselman (junior) sold 2 acres, 2 roods and 1 perch of Lot 10, Concession 6 to the Trustees of the Presbyterian Church. This parcel formed part of Lot EC on the *Plan of South Casselman* and was situated on the north side of what became Principale Street.

Sometime after the purchase of land, the Trustees of the Presbyterian Church in Casselman built a church on the property. Although the early history of the church remains unknown, a cemetery was also located on the property and it appears that many of the parishioners were of English descent. A devastating fire struck the community of Casselman in October 1897, which destroyed the majority of buildings in the town. Accounts of the fire indicate that more than 800 residences were destroyed, leaving most of the community homeless, with nothing more than the clothes they were wearing as their earthly possessions (Ottawa Journal 1897a). Many of the buildings in Casselman were of frame construction, including the Presbyterian Church. Following the fire, the building committee for the Presbyterian Church promised to rebuild and plans for a brick structure were soon in place (Ottawa Journal 1897b). It is believed that the new church building was constructed in the same location as the original structure on the property. This church remained extant until at least 1919, as a newspaper article notes that a funeral was held there for Mrs. Mary Adams of Casselman in July 1919 (Ottawa Journal 1919).

As time passed, the community of Casselman was increasingly inhabited by Francophones, and many of the street names in the town were changed. In 1944, the Trustees of the Casselman United Church (formerly the Presbyterian Church) sold the church property to David Valley. This sale excluded the cemetery lands, which remain under the ownership of the Trustees of the Congregation of South Casselman Village. A transcription of the 10 visible grave markers was undertaken in 1995 by the Ottawa Branch of the Ontario Genealogical Society, which were associated with the burials of 17 people (Table 6; Map 7). The Bereavement Authority of Ontario was contacted regarding any records they may have regarding the cemetery, but no maps or surveys were on file. The cemetery operator (Municipality of Casselman) was able to provide one additional map, but this only shows the legal cemetery boundary (Map 8). The cemetery is currently inactive, and it remains unclear whether there are any unmarked burials within or beyond the current parcel.

Table 6: Summary of Transcribed Burial Markers (Davis 2021)

Marker Number	Name	Date(s)
1	Harvey L. Presley	Died September 4, 1911 (7 months)
2	Roderick R. MacLeod	1851–1921
	Mary MacLeod	1837–1929
3	Ada G. Riddell	Died September 8, 1891 (8 months)
4	Harvey E. Riddell	Died November 20, 1910 (18 years, 6 months, 2 days)
5	Edward E. Riddell	Died October 24, 1917 (50 years)
	John Riddell	1832–1907
	Jane Riddell	1837–1920
	Wesley Riddell	1871–1905
6	[broken stone]	Died November 10, 1896 (1 year, 9 months)
7	Clifford D. Brownell	Died March 26, 1907 (1 year, 6 months, 26 days)
8	Joseph E. Brownell	Died July 11, 1906 (79 years, 1 month, 3 days)
	Pollyann Brownell	Died October 3, 1911 (80 years, 11 months, 8 days)
9	Edgar Brownell	Died December 26, 1906 (48 years)
	Sarah Brownell	Died May 24, 1900 (38 years)
	Arthur Brownell	Died August 8, 1901 (3 years)
	Evelina Brownell	Died June 30, 1896 (10 years)
10	Wellesley Johnstone	Died December 19, 1900 (84 years)

1.3 Archaeological Context

The Stage 1 and 2 assessments were conducted on November 28, 2024, under PIF #P1106-0064-2024 (Stage 2) and #P1106-0066-2025 (Stage 1). ARA utilized an Apple iPhone 15 Pro Max with a built-in GPS/GNSS receiver during the investigation (UTM17/NAD83). The limits of the study area were confirmed using project-specific GIS data translated into GPS points for reference in the field, in combination with aerial imagery showing physical features in relation to the subject lands.

The archaeological context of any given study area must be informed by 1) the condition of the property as found (Section 1.3.1), 2) a summary of registered or known archaeological sites located within a minimum 1 km radius (Section 1.3.2) and 3) descriptions of previous archaeological fieldwork carried out within the limits of, or immediately adjacent to the property (Section 1.3.3).

1.3.1 Condition of the Property

The study area lies within the Great Lakes–St. Lawrence forest region, which is a transitional zone between the southern deciduous forest and the northern boreal forest. This region extends along the St. Lawrence River across central Ontario to Lake Huron and west of Lake Superior along the border with Minnesota, and its southern portion extends into the more populated areas of Ontario. It is dominated by hardwood forests, although coniferous trees such as white pine, red pine, hemlock and white cedar commonly mix with deciduous broad-leaved species like yellow birch, sugar and red maples, basswood and red oak (MNRF 2025).

In terms of local physiography, the subject lands fall within the Russell and Prescott Sand Plains. This region encompasses an area of roughly 148,924 ha and comprises a group of large sand plains separated by the clays of the lower Ottawa Valley. This group consists of one continuous belt

extending from Ottawa to Hawkesbury, three fairly large areas to the north and a number of smaller sandy remnants dispersed over the clay plains (Chapman and Putnam 1984:208–210).

According to the Ontario Soil Survey, the study area consists of Castor fine sandy loam, Eroded Channel, Built Up Area, and Achigan soils. Castor fine sandy loam is made up of dark grey, fine sandy soils with layered silt and fine sand parent materials. Castor fine sandy loam is characterized by a gently undulating topography and imperfect drainage qualities. Areas classified as Eroded Channel are characterized by gully-like channels in cultivated areas as well stream-valley slopes. Eroded Channels serve as drainage throughout landscape. Achigan soils are generally coarse sand and gravel with minor components of silt. They are typical of imperfectly drained lands in the region (Wicklund and Richards 1962). Local surficial geology consists primarily of fine-textured glaciomarine deposits in the west, stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain in the south, and fine-textured glaciomarine deposits in the east (OGS 2010). It is also traversed by several meltwater channels and fluvial terraces.

The subject lands fall within the Lower South Nation River drainage basin, which is under the jurisdiction of South Nation Conservation (SNC 2020). Specifically, the study area is traversed by a tributary of Moose Creek, is immediately adjacent to the South Nation River and within 37 m and 298 m of two tributaries of the South Nation River.

At the time of the assessment, the study area consisted of existing paved and gravel roads, hay pasture and agricultural land, manicured grass, the Main Sewage Pumping Station, raised berms associated with manmade ponds, and existing infrastructure and buried utilities. Soil conditions were ideal for the activities conducted. No unusual physical features were encountered that affected fieldwork strategy decisions or the identification of artifacts or cultural features (e.g., dense root mats, boulders, rubble, etc.).

1.3.2 Registered or Known Archaeological Sites

The Ontario Archaeological Sites Database and the Ontario Public Register of Archaeological Reports were consulted to determine whether any registered or known archaeological resources occur within a 1 km radius of the study area. The available search facility returned two registered sites located within at least a 1 km radius (the facility returns sites in a rectangular area, rather than a radius, potentially resulting in results beyond the specified distance). Three other registered sites should have also been returned (BhFs-1, BhFs-5 and BhFs-6), but these appear to be missing location information in the database. In terms of other known resources, seven unregistered sites were identified within a 1 km radius of the study area. The sites are summarized in Table 7.

Table 7: Registered or Known Archaeological Sites

Borden No. / ID No.	Site Name / Identifier	Time Period	Affinity	Site Type	Distance from Study Area
BhFs-1	Casselman 1	Woodland, Middle	Indigenous	Unknown	50 m–300 m
BhFs-2	Casselman Dam	Post-Contact	Euro-Canadian	Generating station	50 m–300 m
BhFs-5	-	Pre-Contact, Post-Contact	Indigenous, Euro-Canadian	Scatter	50 m–300 m
BhFs-6	Wimbàbikàn	Pre-Contact, Post-Contact	Indigenous, Euro-Canadian	Scatter	50 m–300 m

Borden No. / ID No.	Site Name / Identifier	Time Period	Affinity	Site Type	Distance from Study Area
BhFs-7	Casselman Village	Post-Contact	Euro-Canadian	House	50 m–300 m
Unregistered	FF1	Pre-Contact	Indigenous	Findspot	50 m–300 m
Unregistered	FF2	Pre-Contact	Indigenous	Findspot	50 m–300 m
Unregistered	FF3	Pre-Contact	Indigenous	Findspot	300 m–1 km
Unregistered	FF4	Pre-Contact	Indigenous	Findspot	300 m–1 km
Unregistered	FF5	Pre-Contact	Indigenous	Findspot	300 m–1 km
Unregistered	FF6	Post-Contact	Euro-Canadian	Scatter	50 m–300 m
Unregistered	FF7	Post-Contact	Euro-Canadian	Scatter	300 m–1 km

None of these sites are located within 50 m and do not have the potential to traverse the study area. As sites located on adjacent lands, BhFs-5 and Wimbàbikàn (BhFs-6) are fully discussed in Section 0. Casselman 1 (BhFs-1), Casselman Dam (BhFs-2), the Casselman Village site (BhFs-7), FF1, FF2 and FF6 are located within 300 m of the study area and must also be considered as relevant features of archaeological potential. The remaining sites represent more distant archaeological resources.

1.3.3 Previous Archaeological Work

Reports documenting assessments conducted within the subject lands and assessments that resulted in the discovery of sites within adjacent lands were sought during the research component of the study. In order to ensure that all relevant past work was identified, an investigation was launched to identify reports involving assessments within 50 m of the study area. The investigation determined that there are multiple available reports documenting previous archaeological fieldwork within the specified distance. The relevant results and recommendations are summarized below as required by Section 7.5.8 Standards 4–5 of the 2011 *S&Gs* (Map 10).

1.3.3.1 South Nation River Heritage Study

In 1980, H. Daechsel conducted background research and fieldwork as part of an archaeological evaluation of the South Nation River drainage basin under Licence #80-F-0425 (Daechsel 1980). The investigation was carried out as part of the South Nation River Heritage Study, and two relevant papers were generated: Background Paper #3 (Archaeological Resources) and Background Paper #6 (Representative Heritage Resources). These papers include discussions of Casselman 1 (BhFs-1) and the Casselman Dam site (BhFs-2). The specific areas subject to survey were not identified; accordingly, no attempts were made to include this study in the mapping.

Casselman 1 (BhFs-1) was formally identified by J.F. Pendergast in 1959 and may have been visited by W.J. Wintemberg in 1912. Although its exact location remains unknown, it was reportedly documented just north of Casselman on the east bank of the South Nation River. The majority of the original finds consisted of ceramic sherds from the Middle Woodland period, but Daechsel's brief reconnaissance of the area in 1980 failed to relocate the site. Due to its location in the low flood plain area, it was suggested that the site may have eroded away. The associated site record form does not provide any additional information pertaining to the deposit.

Casselman 2, subsequently registered as the Casselman Dam site (BhFs-2), comprises the dam, flume and adjacent powerhouse (referred to as the 'mill portion' in the associated site record form). These features were observed during the survey work in 1980. Although the surrounding soil was thin, surface debris, including ceramics and iron tools, suggested that there was an archaeological component to this industrial site. The site record form states that no artifacts were recovered.

1.3.3.2 Nationview Village Site Development Project (Stages 1–4)

In May 2010, Stage 1 and 2 assessments were carried out for the Nationview Village Site development located at 810 Principale Street under PIF #P325-007-2010 (IE 2011). The assessed area traverses a portion of the study area. The overlapping area was assessed by pedestrian survey at 5 m intervals, but no archaeological resources were identified, and it is of no further concern. The wider investigation resulted in the discovery of nine locations of archaeological materials, none of which are within adjacent lands and have no potential of traversing the study area. BhFs-5 and BhFs-6 were found to be of further cultural heritage value or interest (CHVI), and each site was recommended for a Stage 3 site-specific assessment (IE 2011:13).

In June 2010, the Stage 3 assessments were carried out at sites BhFs-5 and BhFs-6 located under PIF# P325-005-2010 and PIF# P325-006-2010 (IE 2011). Both sites were excavated on a 5 m grid with a total of 34 1 m^2 test units excavated for BhFs-5 and 15 1 m^2 test units excavated for BhFs-6 which yielded 255 and 52 total artifacts, respectively. The assessment results determined that both sites possessed a minor historic component in keeping with agricultural functions. The bulk of the assemblages from both sites were largely Indigenous and comprised primarily quartz flakes but also included ground stone tools, chert flakes, as well as informal and formal tools made of both cherts and quartz. Onondaga and Kichissippi chert were the primary chert types recovered from both sites, with pot-lidding evident on the sample of Onondaga. It was concluded that both BhFs-5 and BhFs-6 were tool-manufacturing sites, likely dating to the Middle to Late Archaic periods, and require a Stage 4 mitigation of development impacts.

The Stage 4 archaeological excavation of sites BhFs-5 and BhFs-6 occurred between June 2010 to June 2011 under PIFs #P325-009-2020 and #P325-011-2011 (IE 2011a, IE 2011b). A total of 256 1 m^2 block units were excavated for BhFs-5, and 7,376 artifacts were recovered while a total of 106 1m^2 block units were excavated for BhFs-6 with 1,236 artifacts recovered. Due to the aceramic nature of the sites and the presence of ground stone tools, it is suggested that the sites date to the Middle to Late Archaic periods. Impacts to the site were deemed mitigated through full excavation and the sites had no further archaeological concern.

1.3.3.3 Casselman Sentier Brisson Waterfront (Stage 1–2)

In May 2023, a Stage 1 assessment was conducted for the Sentier Brisson Waterfront Project under PIF #P007-1477-2023 (ARA 2023). The assessed area overlaps the western section of the study area along Brisson Street. The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. Potential for deeply buried human remains and/or burial features was identified in the vicinity of the Brisson J. Farm Cemetery (CM-2003171) in the southeast. It was recommended that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 assessment. The assessed portion that overlaps the current study area on the eastern side of Brisson Street was

recommended for combination test pit survey and visual inspection to confirm the limits of disturbance within the right-of-way and test-pit survey at 5 m intervals for areas beyond the right-of-way while Brisson Street itself was determined to not possess archaeological potential.

The Stage 2 archaeological assessment for these lands along the northern extent of Brisson Street were completed in November 2023 under PIF #P1146-0017-2023 (ARA 2024). The southeast section of this assessment overlapped with the current study area. These lands were subject to visual inspection, test pit survey at 5 m intervals, and a combination of visual inspection and test pit survey. No archaeological resources were identified, and no further work was recommended. At the time of writing, the associated reports for the Stage 1 and 2 assessments are presently under Ministry review and have not been entered into the Ontario Public Register of Archaeological Reports. Until such a time, their results are considered preliminary.

1.3.3.4 Casselman Main Sewage Pumping Station (Stage 1)

In July 2024, the current project area was subject to a Stage 1 assessment under PIF #P1106-0051-2024 (ARA n.d.). The assessment overlaps a large portion of the current study area except for a shift in the detail design within the northeastern Casselman lagoons. It was determined that these overlapping areas were determined to be a mixture of areas of archaeological potential, areas of no archaeological potential, areas previously assessed of further concern and areas previously assessed and of no further concern.

The areas previously assessed of further concern were drawn from the 2024 ARA Stage 1 assessment which recommended test pitting at intervals around the SPS and the right-of-way of Brisson Street. Several areas previously determined to have archaeological potential by the 2024 assessment were determined to have no archaeological potential based on documentation from when the SPS was built in 2005, replacing a prior and smaller structure; the current force main was installed in 2006; and an additional manhole adjacent to the SPS was constructed in 2007. The previous assessment included recommendations for the adjacent Brisson J. Farm Cemetery (CM-2003171). These recommendations are beyond the scope of the current assessment and still need to be addressed prior to development and/or ground disturbance. The following methods were recommended by the Stage 1 archaeological assessment for the current study area (ARA, n.d):

> The Stage 1 assessment determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. Potential for deeply buried human remains and/or burial features was identified in the vicinity of the Brisson J. Farm Cemetery (CM-2003171) in the southeast.
>
> It is recommended that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 *S&Gs*. Deep land alterations have resulted in the removal of archaeological potential from the Casselman Lagoons, Brisson Street and Laurier Street, the extant driveways and parking areas, the lands around the SPS, and lands altered for infrastructure and utilities. The disturbed lands do not require any additional assessment. The current study area does not include the South Nation River but is adjacent. Should any in-water work be planned within the waterway, the Criteria for Evaluating Marine Archaeological Potential checklist should be consulted.

A cemetery investigation must also be carried out in the vicinity of the Brisson J. Farm Cemetery (CM-2003171) to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO.

The grassed areas to the east of Brisson Street and the wooded areas west of the SPS must be assessed using the test pit survey method. A survey interval of 5 m will be required due to the proximity of the lands to the identified features of archaeological potential. Given the likelihood that the grassed areas east of Brisson Street and immediately adjacent to the roadway were previously impacted, a combination of visual inspection and test pit survey should be utilized to confirm the extent of disturbance in accordance with Section 2.1.8 of the 2011 *S&Gs*. This will allow for the empirical evaluation of the integrity of the soils and the depth of any impacts as well as facilitate the identification of any archaeological resources.

The cemetery investigation in the vicinity of the Brisson J. Farm Cemetery must be preceded by a combination of visual inspection and test pit survey to determine whether there are any surficial archaeological resources. Based on the current landscape and the results of the background research, a 10 m investigation buffer is warranted. Provided that no archaeological resources with CHVI are identified, mechanical topsoil removal must then be carried out within the 10 m investigation buffer to determine whether any unmarked graves are present. The excavation should begin at the edge of Brisson Street and continue easterly towards the legal cemetery boundary. To avoid damage to potential features and/or human remains, an excavator with an articulated wrist and a flat-edged bucket must be utilized to remove the topsoil. The removals should be conducted incrementally to limit potential impacts to any shallow burials. Mechanical excavation must continue until the topsoil/subsoil interface is reached; this interface must then be subjected to a close examination for potential features and shovel shined or trowelled to further clarify the interface in accordance with the requirements set out in Section 4.2.3 of the 2011 *S&Gs*.

If any burial features (e.g., grave shafts or coffin stains) are encountered, they must be fully documented in order to satisfy the requirements and objectives set out in the *Funeral, Burial and Cremation Services Act, 2002*, Section 174 of Ontario Regulation 30/11 as well as Section 4.2.1 Standard 9 and Section 4.2.2 Standard 7 of the 2011 *S&Gs*. Authorization from the BAO would be required before any further excavation to confirm the presence/absence of human remains. Disarticulated human remains found in secondary contexts must also be recorded. Mechanical excavation must be extended for a minimum of 10 m beyond any burial features.

2.0 STAGE 1 BACKGROUND STUDY

2.1 Background

The Stage 1 assessment involved background research to document the geography, history, previous archaeological fieldwork and current land condition of the study area. This desktop examination included research from archival sources, archaeological publications and online databases. It also included the analysis of a variety of historical maps and aerial imagery. The results of the research conducted for the background study are summarized below.

With occupation beginning approximately 10,000 years ago, the greater vicinity of the study area comprises a complex chronology of Pre-Contact and Post-Contact histories (Section 1.2.1). Artifacts associated with Archaic, Woodland and Early Contact traditions are relatively well-attested in the United Counties of Prescott and Russell, and Euro-Canadian archaeological sites dating to pre-1900 and post-1900 contexts are likewise common. The presence of 12 previously identified sites in the surrounding area demonstrates the desirability of this locality for early settlement (Section 1.3.2). Background research determined that an early archaeological survey included near the study area (Section 0).

The natural environment of the study area would have been attractive to both Indigenous and Euro-Canadian populations as a result of proximity to the South Nation River and its tributaries. The relatively well-drained soils and fluvial terraces would have been ideal for occupation and agriculture, and the diverse local vegetation would also have encouraged settlement throughout Ontario's lengthy history. Euro-Canadian populations would have been particularly drawn to the logging opportunities in the area and later to the thoroughfares and amenities within the historical community of Casselman.

In summary, the background study included an up-to-date listing of sites from the Ontario Archaeological Sites Database (within at least a 1 km radius), the consideration of previous local archaeological fieldwork (within at least a 50 m radius), the analysis of historical maps (at the most detailed scale available) and the study of aerial imagery. ARA, therefore, confirms that the standards for background research set out in Section 1.1 of the 2011 *S&Gs* were met.

2.2 Field Methods (Property Inspection)

Since the Stage 1 and 2 archaeological assessments were carried out concurrently, a separate property inspection was not completed as part of the Stage 1 background study. Instead, the visual inspection was conducted over the course of the Stage 2 property survey, in keeping with the concepts set out in Section 2.1 Standards 2a–b of the 2011 *S&Gs*. The specific field methods utilized during the visual inspection and the weather and lighting conditions at the time of assessment are summarized in Section 3.1 (Stage 2).

2.3 Analysis and Conclusions

In addition to relevant historical sources and the results of past archaeological assessments, the archaeological potential of a property can be assessed using its soils, hydrology and landforms as considerations. Section 1.3.1 of the 2011 *S&Gs* recognizes the following features or characteristics

as indicators of archaeological potential: previously identified sites, water sources (past and present), elevated topography, pockets of well-drained sandy soil, distinctive land formations, resource areas, areas of Euro-Canadian settlement, early transportation routes, listed or designated properties, historic landmarks or sites, and areas that local histories or informants have identified with possible sites, events, activities or occupations.

The Stage 1 assessment resulted in the identification of several features of archaeological potential in the vicinity of the study area (Map 9). The closest and most relevant indicators of archaeological potential (i.e., those that would affect survey interval requirements) include multiple previously identified sites (i.e. BhFs-5 and BhFs-6), several primary water sources (the South Nation River, its tributaries and the tributaries of Moose Creek), multiple physiographic landforms (terraces and abandoned channels), one historical railway (the Canada Atlantic Railway), two historical roadways (Principale Street and Laurier Street) and one historical cemetery (the Brisson J. Farm Cemetery).

Background research determined that the Brisson J. Farm Cemetery falls within lands sold to the Trustees of the Presbyterian Church in 1885. A frame church and cemetery were subsequently established on the property, and the church was rebuilt in brick following its destruction in 1897. The church likely went out of use prior to the sale of the land to David Valley in 1944, which excluded the cemetery portion. There are currently 10 visible grave makers associated with the burials of 17 individuals within the cemetery parcel, the earliest of which dates to 1891. There are no plot maps or other records available that provide any reliable indication of the extent of the burial ground. The cemetery, therefore, does not have clearly defined historical boundaries, and it is possible that some interments occurred beyond the legal property limits. ARA determined that the parts of the study area falling within 10 m of the cemetery have the potential for deeply buried burial features (ARA 2023, ARA, 2025 [forthcoming]). Background research identified the potential for deeply buried human remains and/or burial features was identified in the vicinity of the Brisson J. Farm Cemetery (CM-2003171) in the southeast.

Although proximity to a feature of archaeological potential is a significant factor in the potential modelling process, current land conditions must also be considered. Section 1.3.2 of the 2011 *S&Gs* emphasizes that 1) quarrying, 2) major landscaping involving grading below topsoil, 3) building footprints and 4) sewage/infrastructure development can result in the removal of archaeological potential, and Section 2.1 states that 1) permanently wet areas, 2) exposed bedrock and 3) steep slopes (> 20°) in areas unlikely to contain pictographs or petroglyphs can also be evaluated as having no or low archaeological potential. Areas previously assessed and not recommended for further work also require no further assessment.

Three assessments overlap the current study area. The Stage 1 assessment under PIF #P007-1477-2023 still has several recommendations in the southwest of the study area not previously addressed by the Stage 2 assessment of the Sentier Brisson Waterfront Project (PIF #P1146-0017-2023), which remain areas of further archaeological concern. These recommendations were broadly adopted for the subject investigation except for areas documented as previously disturbed in the Stage 1 assessment of Casselman Main SPS (#P1106-0051-2024). Areas assessed by the Sentier Brisson Waterfront Project Stage 2 assessment (#P1146-0017-2023) are of no further concern pending review of the report by the MCM. The northwest is overlapped by areas assessed under

PIF #P325-007-2010, which meet current provincial standards (i.e., pedestrian survey at 5 m) and, therefore, do not require additional assessment and are of no further concern.

ARA's visual inspection, coupled with the analysis of historical sources and digital environmental data, identified several areas of no archaeological potential. Since these areas of no archaeological potential were identified over the course of the Stage 2 property survey, they are fully discussed in Section 3.1. The remainder of the study area had archaeological potential and required further assessment.

3.0 STAGE 2 PROPERTY ASSESSMENT

3.1 Field Methods

The Stage 2 assessment involved visual inspection, pedestrian survey, and test pit survey. Environmental conditions were ideal during the investigation, permitting good visibility of land features and providing an increased chance of finding evidence of archaeological resources. A breakdown of the specific fieldwork activities, weather and lighting conditions appears in Table 8. ARA, therefore, confirms that fieldwork was carried out under weather and lighting conditions that met or exceeded the requirements set out in Section 1.2 Standard 2 and Section 2.1 Standard 3 of the 2011 *S&Gs*.

Table 8: Fieldwork Activities and Environmental Conditions

Date	Activity	Lighting	Cloud Cover	Precipitation	Temperature (°C)
28/11/2024	Test Pit Survey	Diffuse	Partly Cloudy	None	5

The study area was subjected to a systematic visual inspection in accordance with the requirements set out in Section 1.2 of the 2011 *S&Gs*. This component of the investigation was conducted concurrently with the property survey. The inspection confirmed that all surficial features of archaeological potential were present where they were previously identified and did not result in the identification of any additional features of archaeological potential not visible on mapping (e.g., relic water channels, patches of well-drained soils, etc.).

The visual inspection resulted in the identification of an additional area of disturbance related to the berms of the Casselman lagoons and their buried infrastructure (Image 1–Image 4). These areas had clearly been impacted by past earth-moving/construction activities, resulting in the disturbance of the original soils to a significant depth and severe damage to the integrity of any archaeological resources. Additional areas of no archaeological potential include the sloped lands west of the Main SPS which descend into the South Nation River (Image 5–Image 6). No other natural features (e.g., overgrown vegetation, heavier soils than expected, etc.) that would affect assessment strategies were identified. The Brisson J. Farm Cemetery was visible to the east of Brisson Street and was photo-documented and discussed in Section 2.3. Multiple built heritage resources and cultural heritage landscapes were identified during ARA's heritage assessments for the current and adjacent projects (ARA 2023a; ARA 2024b). No other significant built features (e.g., monuments, etc.) were encountered.

The test pit survey method was utilized to complete the assessment west of the Main SPS and east of Brisson Street because ploughing was not possible or viable (Image 7–Image 8). Using this method, ARA crewmembers hand excavated small regular test pits with a minimum diameter of 30 cm at prescribed intervals in accordance with Section 2.1.2 of the 2011 *S&Gs*. Since the areas to be tested were located less than 300 m from any feature of archaeological potential, a maximum interval of 5 m was warranted (Image 7–Image 8). Extensive disturbance was encountered to the west of the SPS, but due to the small study area, the interval was not modified.

Each test pit was excavated into at least the first 5 cm of subsoil, and the resultant pits were examined for stratigraphy, potential features and/or evidence of fill. Disturbed soils were encountered to the west of the SPS, which comprised heavily mottled dark brown silt loam with clay, asphalt, cement, gravel, and cobble inclusions to a depth of 80 cm overtop a light brownish yellow sand subsoil. Natural soils were encountered to the east of Brisson Street, which comprised dark brown silt loam topsoil to a depth of 25–30 cm over pale brownish-yellow silt subsoil (Image 9–Image 12). All soils were screened through mesh with an aperture of no greater than 6 mm and examined for archaeological resources. No locations of archaeological materials were encountered during the test pit survey. The test pits were backfilled upon completion.

The utilized field methods are presented in Map 10–Map 10. The study area is depicted as a layer in these maps. A breakdown of field methods appears in Table 9.

Table 9: Field Methods

Category	Breakdown
Pedestrian survey at an interval of 5 m	0.00% (0.00 ha)
Test pit survey at an interval of 5 m	4.75% (0.20 ha)
Test pit survey at an interval of 10 m	0.00% (0.00 ha)
Test pit survey at a modified interval due to physical constraint	0.00% (0.00 ha)
Combination of visual inspection and test pit survey to confirm disturbance	0.00% (0.00 ha)
Not assessed due to physical constraint	0.00% (0.00 ha)
Not assessed due to permanently wet areas	0.00% (0.00 ha)
Not assessed due to exposed bedrock	0.00% (0.00 ha)
Not assessed due to sloped areas	0.28% (0.01 ha)
Not assessed due to disturbed areas	44.31% (01.90 ha)
Previously assessed and of no further concern	50.66% (2.17 ha)
Total	100.00% (4.29 ha)

3.2 Record of Finds

The investigation did not result in the discovery of any archaeological materials. An inventory of the documentary record generated in the field is presented in Table 10.

Table 10: Documentary Record

Category	Total	Nature	Location
Field notes	1	Digital	50 Nebo Road, Unit 1, Hamilton
Maps	1	Digital	50 Nebo Road, Unit 1, Hamilton
Photographs	34	Digital	50 Nebo Road, Unit 1, Hamilton

3.3 Analysis and Conclusions

No archaeological sites were identified within the assessed lands.

4.0 RECOMMENDATIONS

The Stage 1 assessment determined that the study area comprised a mixture of areas of archaeological potential, and areas of no archaeological potential. The Stage 2 assessment did not result in the identification of any archaeological materials. It is recommended that no further assessment be required within the property. Potential for deeply buried human remains and/or burial features remains in the vicinity of the Brisson J. Farm Cemetery (CM-2003171) in the southeast and a cemetery investigation must be carried out to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO.

Based on the current landscape and the results of the background research, a 10 m investigation buffer is warranted. Provided that no archaeological resources with CHVI are identified, mechanical topsoil removal must then be carried out within 10 m investigation buffer to determine whether any unmarked graves are present. The excavation should begin at the edge of Brisson Street and continue easterly towards the legal cemetery boundary. To avoid damage to potential features and/or human remains, an excavator with an articulated wrist and a flat-edged bucket must be utilized to remove the topsoil. The removals should be conducted incrementally to limit potential impacts to any shallow burials. Mechanical excavation must continue until the topsoil/subsoil interface is reached; this interface must then be subjected to a close examination for potential features and shovel shined or trowelled to further clarify the interface in accordance with the requirements set out in Section 4.2.3 of the 2011 *S&Gs*.

If any burial features (e.g., grave shafts or coffin stains) are encountered, they must be fully documented in order to satisfy the requirements and objectives set out in the *Funeral, Burial and Cremation Services Act, 2002*, Section 174 of Ontario Regulation 30/11 as well as Section 4.2.1 Standard 9 and Section 4.2.2 Standard 7 of the 2011 *S&Gs*. Authorization from the BAO would be required before any further excavation to confirm the presence/absence of human remains. Disarticulated human remains found in secondary contexts must also be recorded. Mechanical excavation must be extended for a minimum of 10 m beyond any burial features.

The current study area does not include the South Nation River but is adjacent. Should any in-water work be planned within the waterway, the Criteria for Evaluating Marine Archaeological Potential checklist should be consulted.

The possibility always remains some archaeological resources or relevant information may be missed following an archaeological assessment. Should previously undocumented archaeological resources or ancestral remains be discovered during the development process, the proponent or person discovering the archaeological resources must cease alteration of the site immediately, contact a licensed consultant archaeologist, and notify the following Indigenous communities:

- Algonquins of Ontario Consultation Office
    - 31 Riverside Drive, Suite 101, Pembroke, Ontario K8A 8R6; Tel: (613) 735-3759; Fax: (613) 735-6307; Email: algonquins@tanakiwin.com;
- Algonquins of Pikwàkanagàn

  - Tel: (613) 625-4010; Email: Consultation@pikwakanagan.ca; Please see Appendix A for AOPFN's Chance Find Protocol;
- Huron-Wendat Nation
  - 255, place Chef Michel Laveau, Wendake (QC), G0A 4V0; Tel: (418)-843-3767; Email: consultations@wendake.ca;
- Métis Nation of Ontario
  - Contact a Métis archaeologist or MNO R6CC; Email: Consultations@metisnation.org;

5.0 ADVICE ON COMPLIANCE WITH LEGISLATION

Section 7.5.9 of the 2011 *S&Gs* requires that the following information be provided for the benefit of the proponent and approval authority in the land use planning and development process:

- This report is submitted to the Minister of Citizenship and Multiculturalism as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MCM, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.
- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar at the Ministry of Public and Business Service Delivery.

6.0 IMAGES

Image 1: Disturbed Lands
(November 28, 2024; Facing Northwest)

Image 2: Disturbed Lands
(November 28, 2024; Facing Northwest)

Image 3: Disturbed Lands
(November 28, 2024; Facing Northeast)

Image 4: Disturbed Lands
(November 28, 2024; Facing Southeast)

Image 5: Sloping Lands
(November 28, 2024; Facing Southwest)

Image 6: Sloping Lands
(November 28, 2024; Facing South)

Image 7: Field Conditions
(November 28, 2024; Facing West)

Image 8: Field Conditions
(November 28, 2024; Facing Northeast)

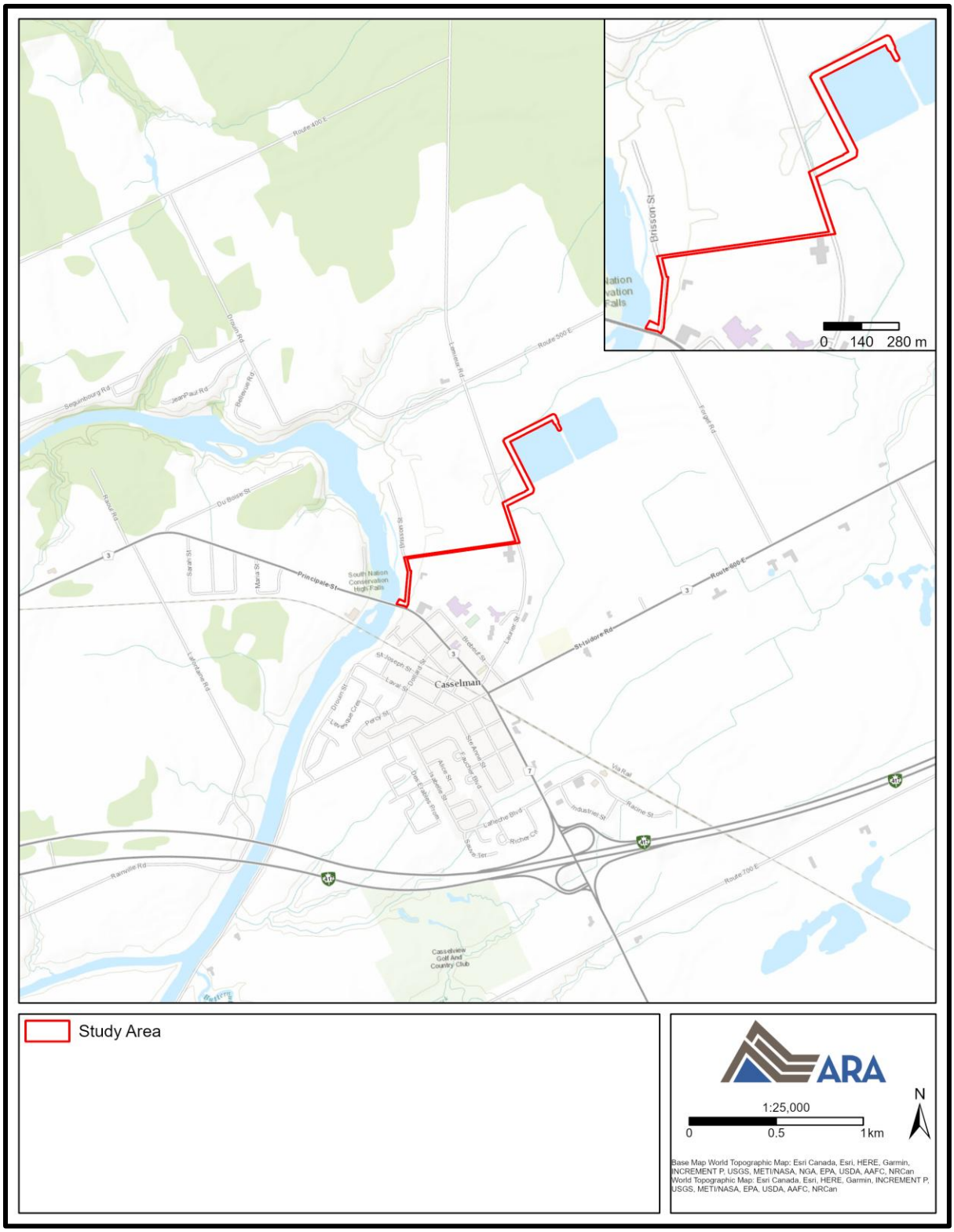
Image 9: Test Pit Survey
(November 28, 2024; Facing Northeast)

Image 10: Test Pit Survey
(November 28, 2024; Facing North)

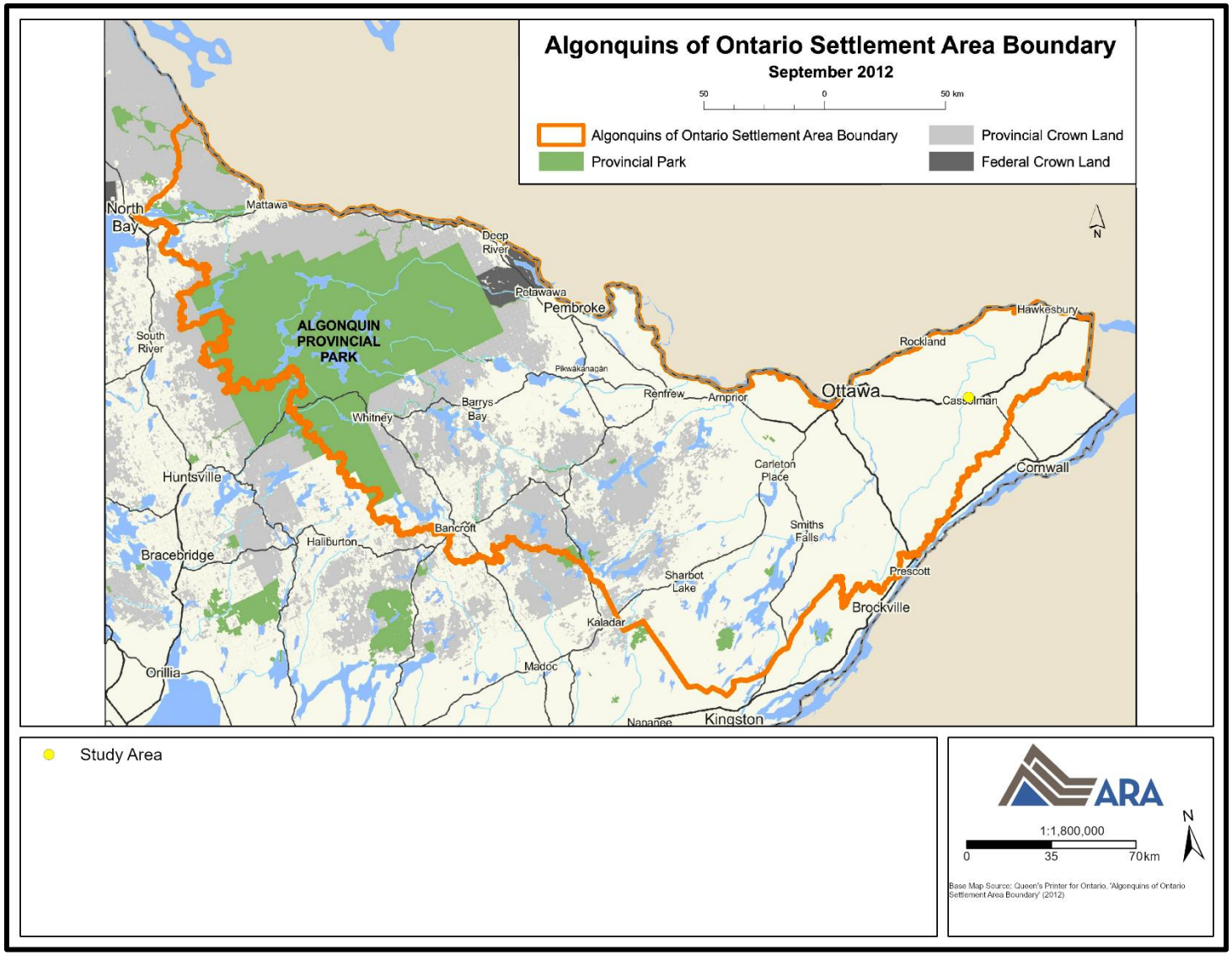
Image 11: Test Pit Survey
(November 28, 2024; Facing North)

Image 12: Test Pit Survey
(November 28, 2024; Facing North)

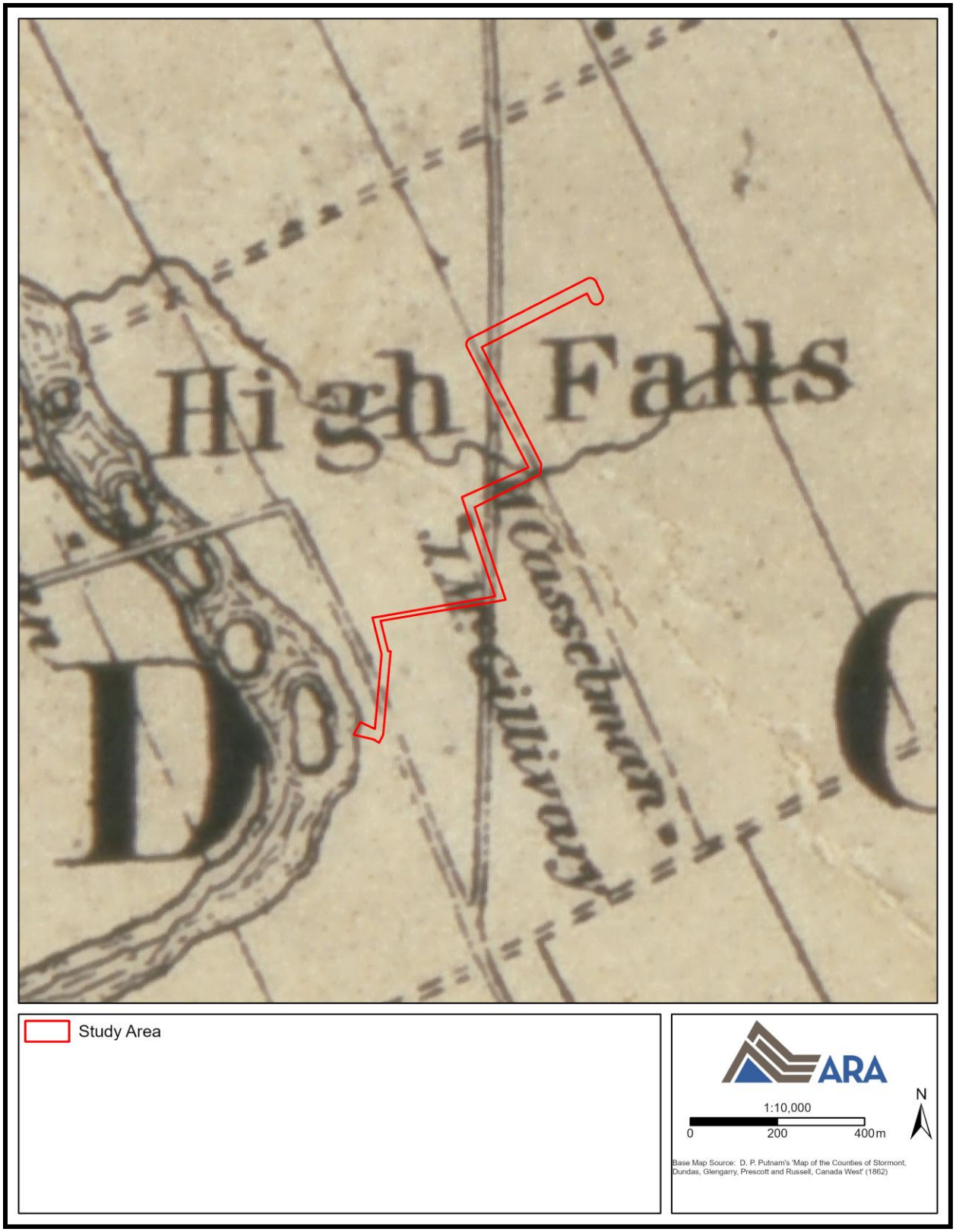
7.0 MAPS



Map 1: Location of the Study Area
(Produced under licence using ArcGIS® software by Esri, © Esri)

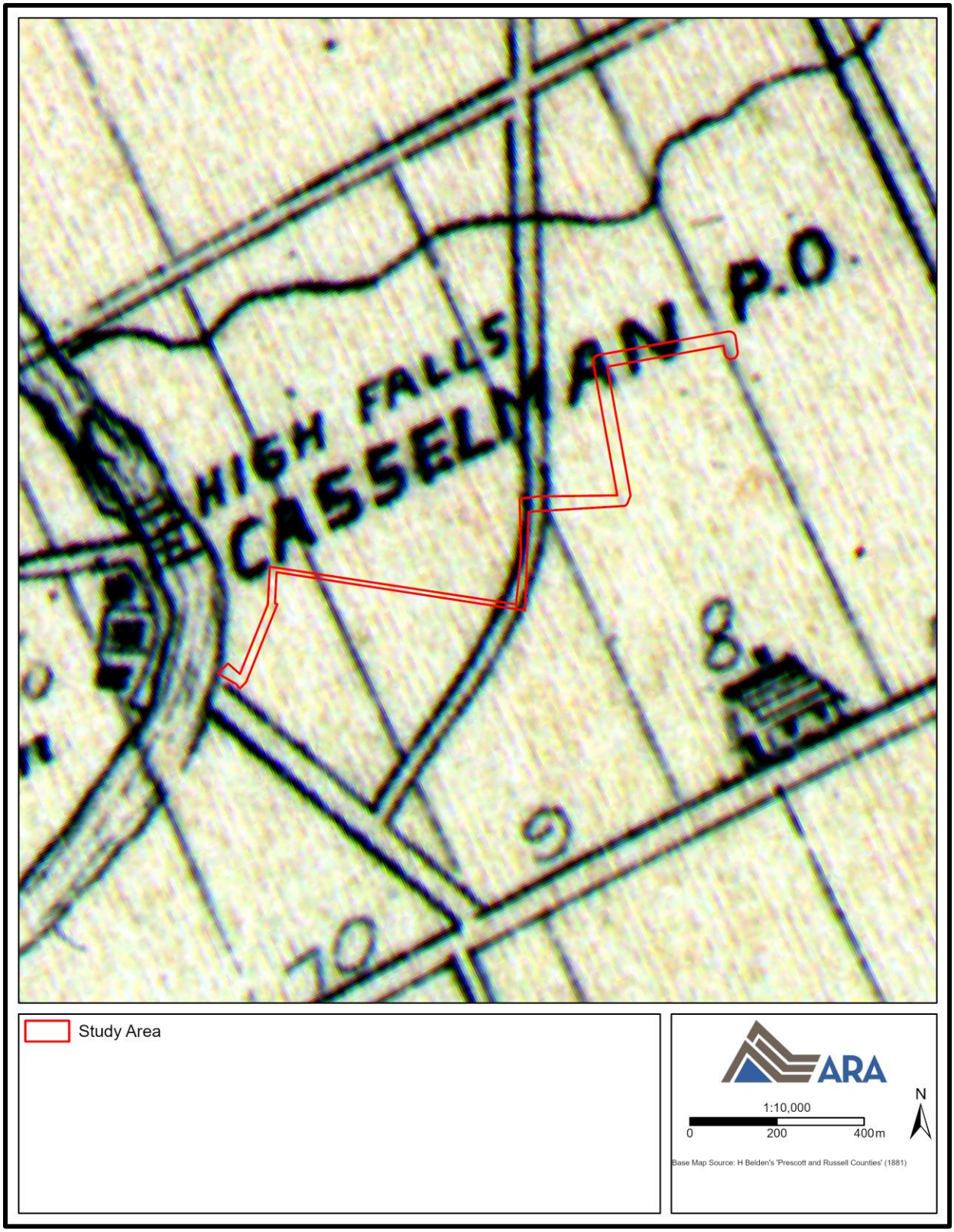


Map 2: Algonquins of Ontario Settlement Area Boundary
(Produced under licence using ArcGIS® software by Esri, © Esri; MIA 2025)

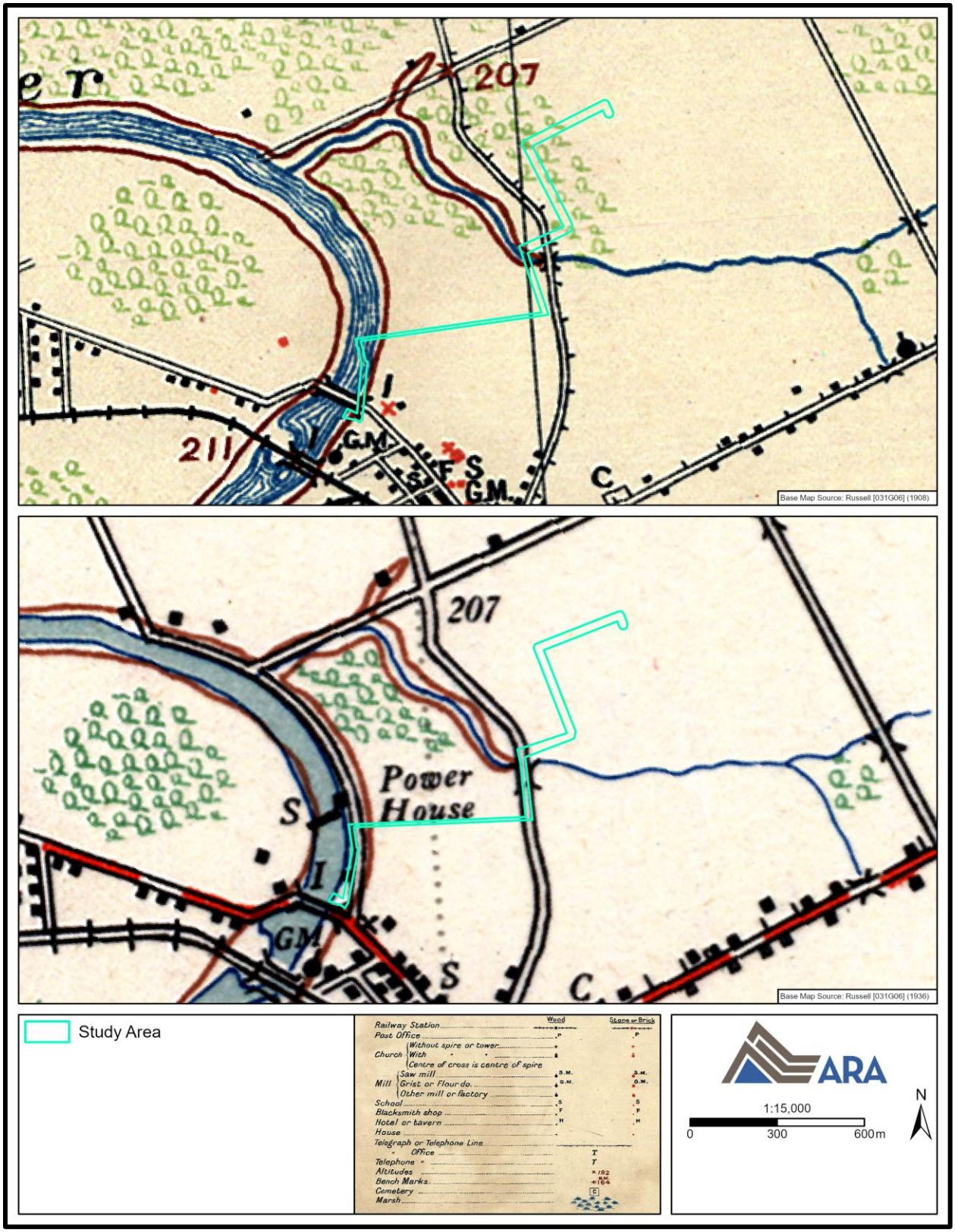


Map 3: ***Map of the Counties of Stormont, Dundas, Glengarry, Prescott and Russell*** **(1862)**

(Produced under licence using ArcGIS® software by Esri, © Esri; OHCMP 2019)

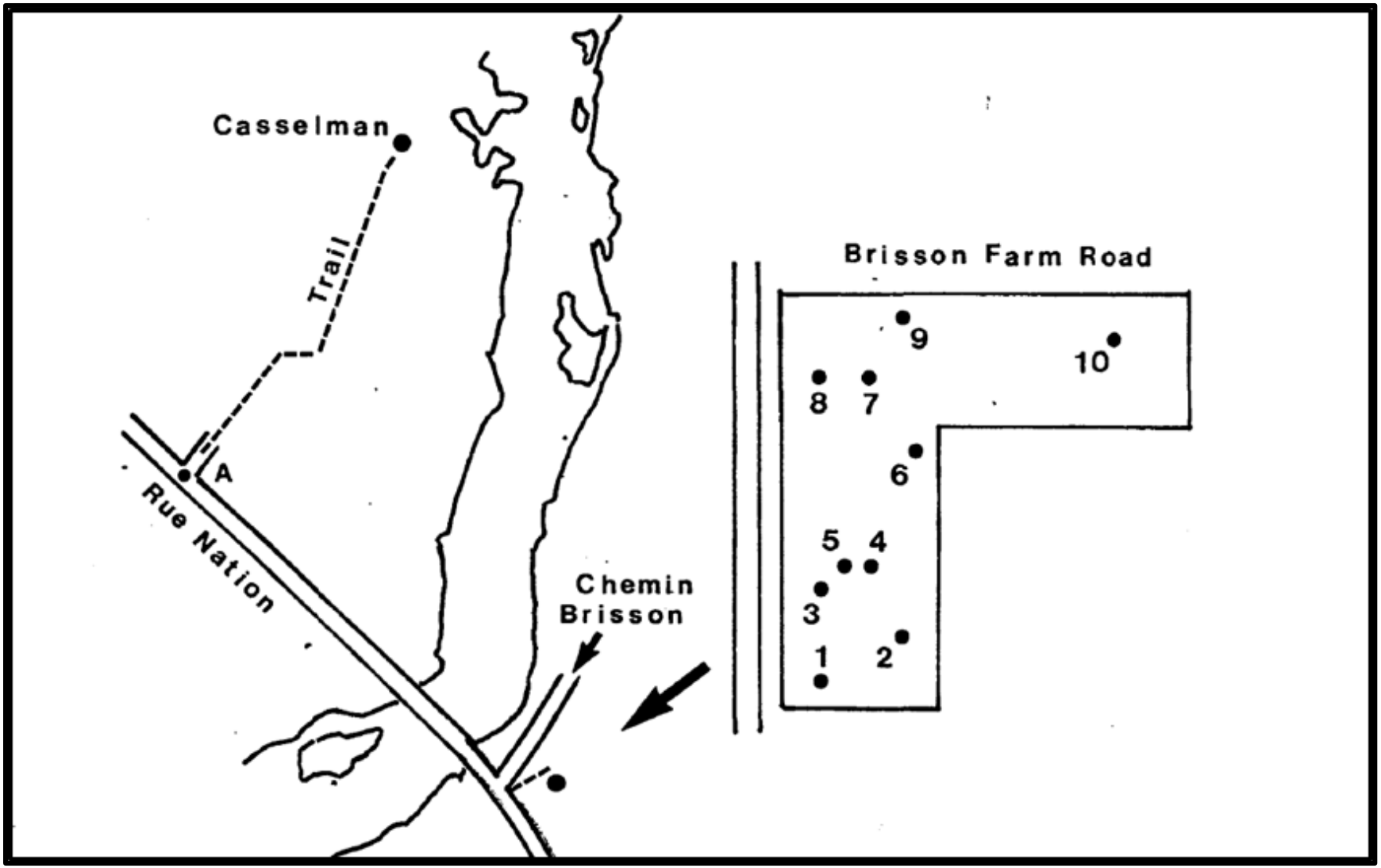


Map 4: *Prescott and Russell Supplement in the Illustrated Atlas* (1881)
(Produced under licence using ArcGIS® software by Esri, © Esri; MU 2001)

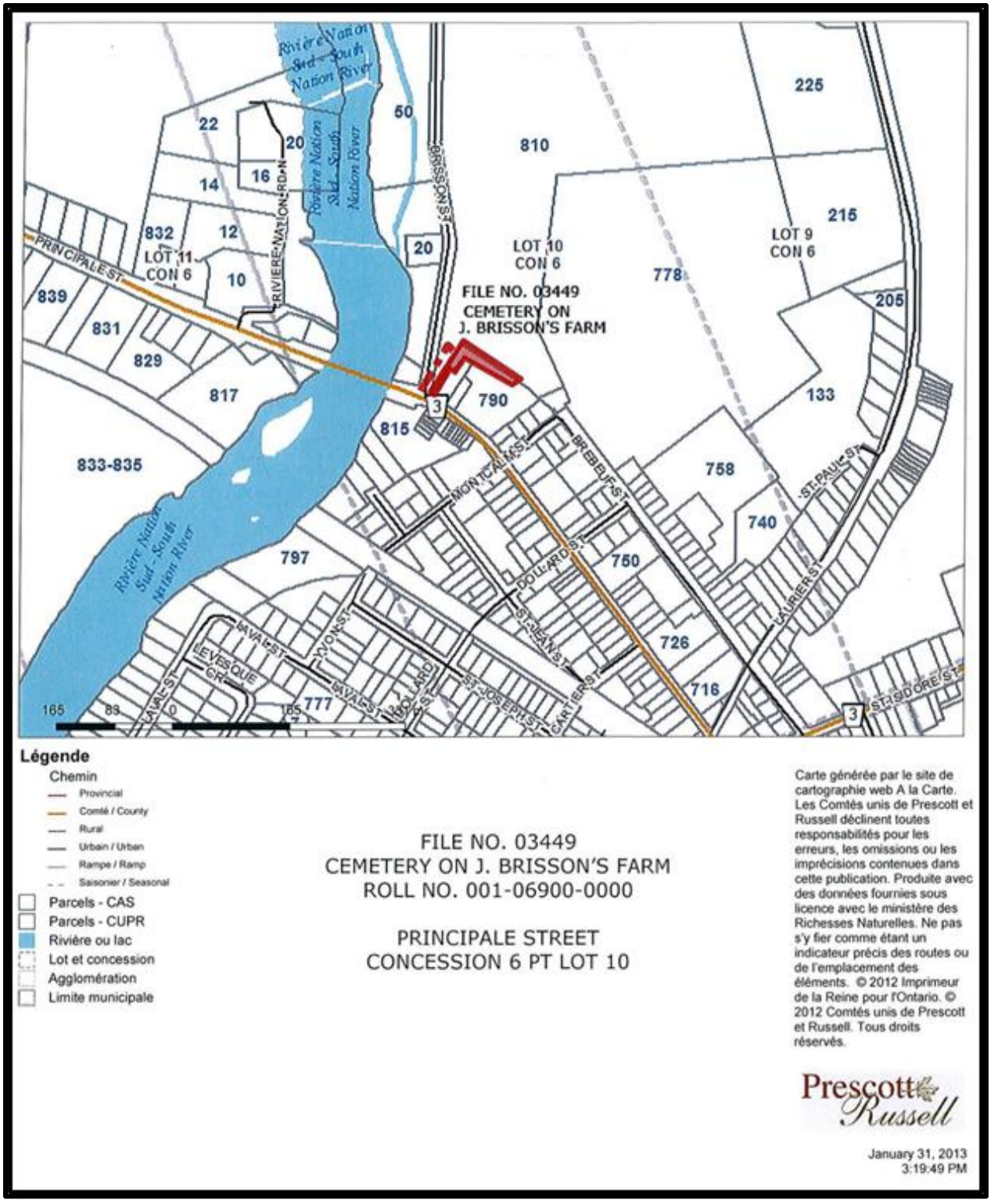


Map 5: Topographic Maps (1908 and 1936)
(Produced under licence using ArcGIS® software by Esri, © Esri; OCUL 2024)

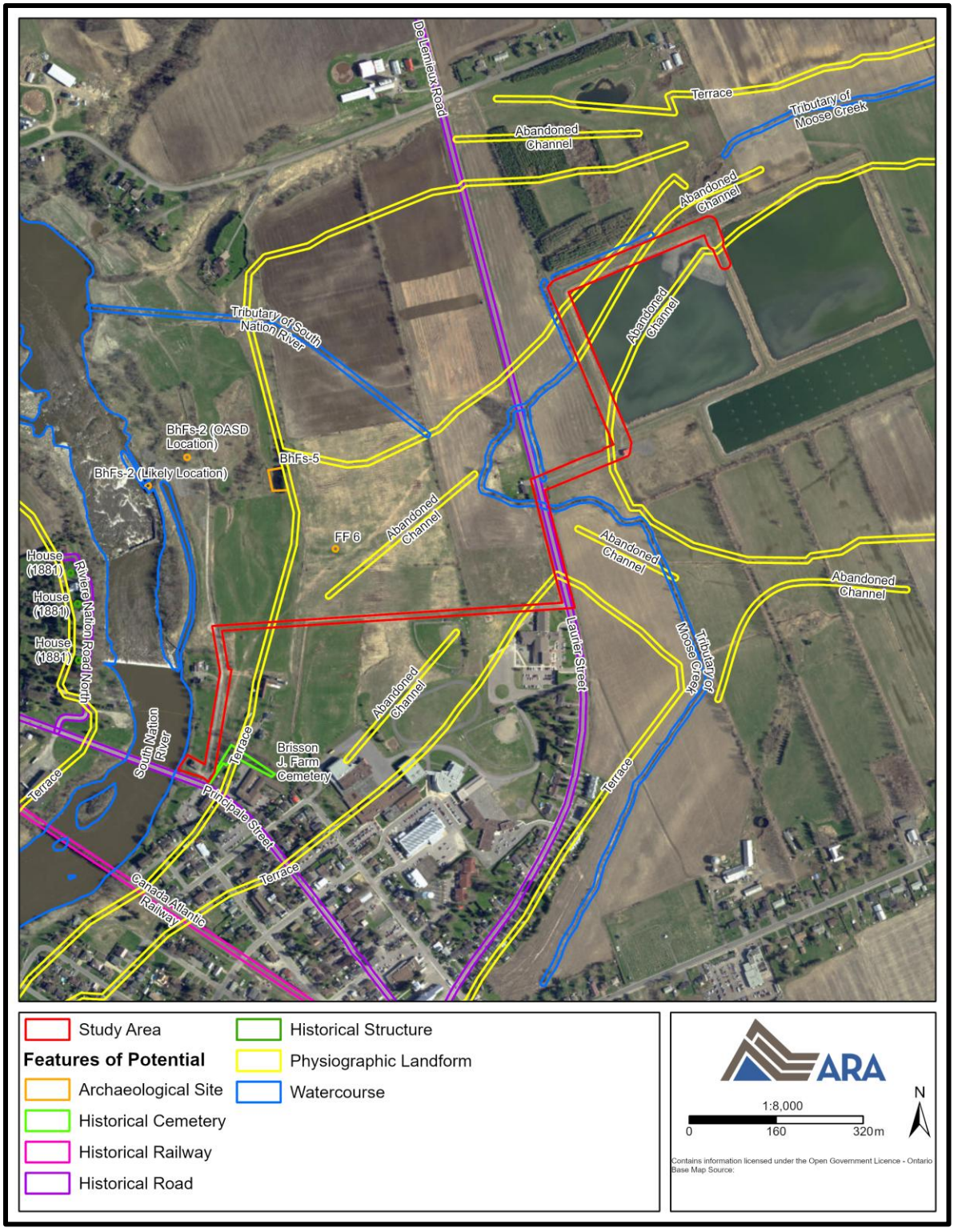
Map 6: Aerial Image (1954)
(Produced under licence using ArcGIS® software by Esri, © Esri; U of T 2025)



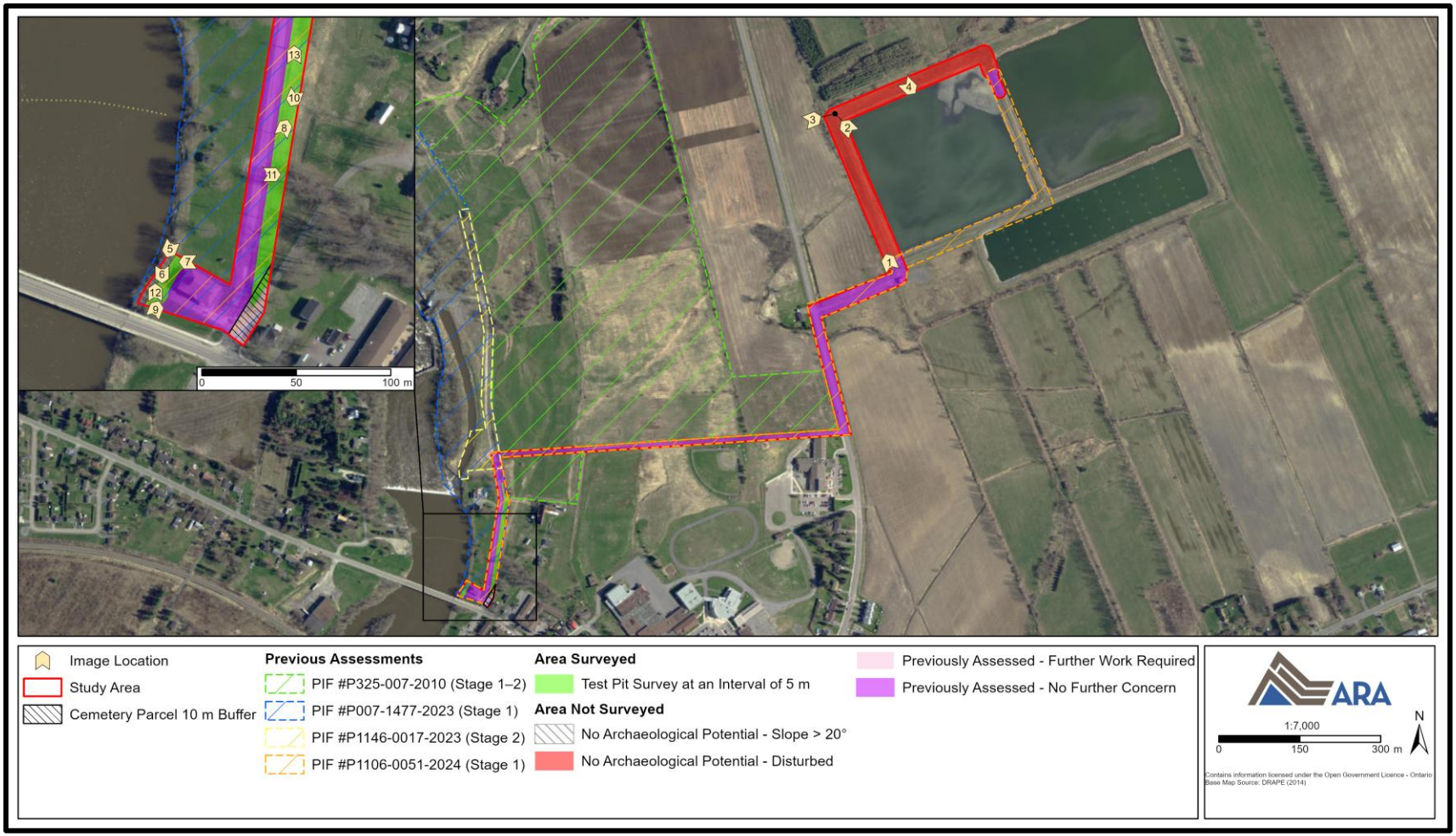
Map 7: Brisson J. Farm Cemetery (Sketch Map)
(OGS 2021:1)



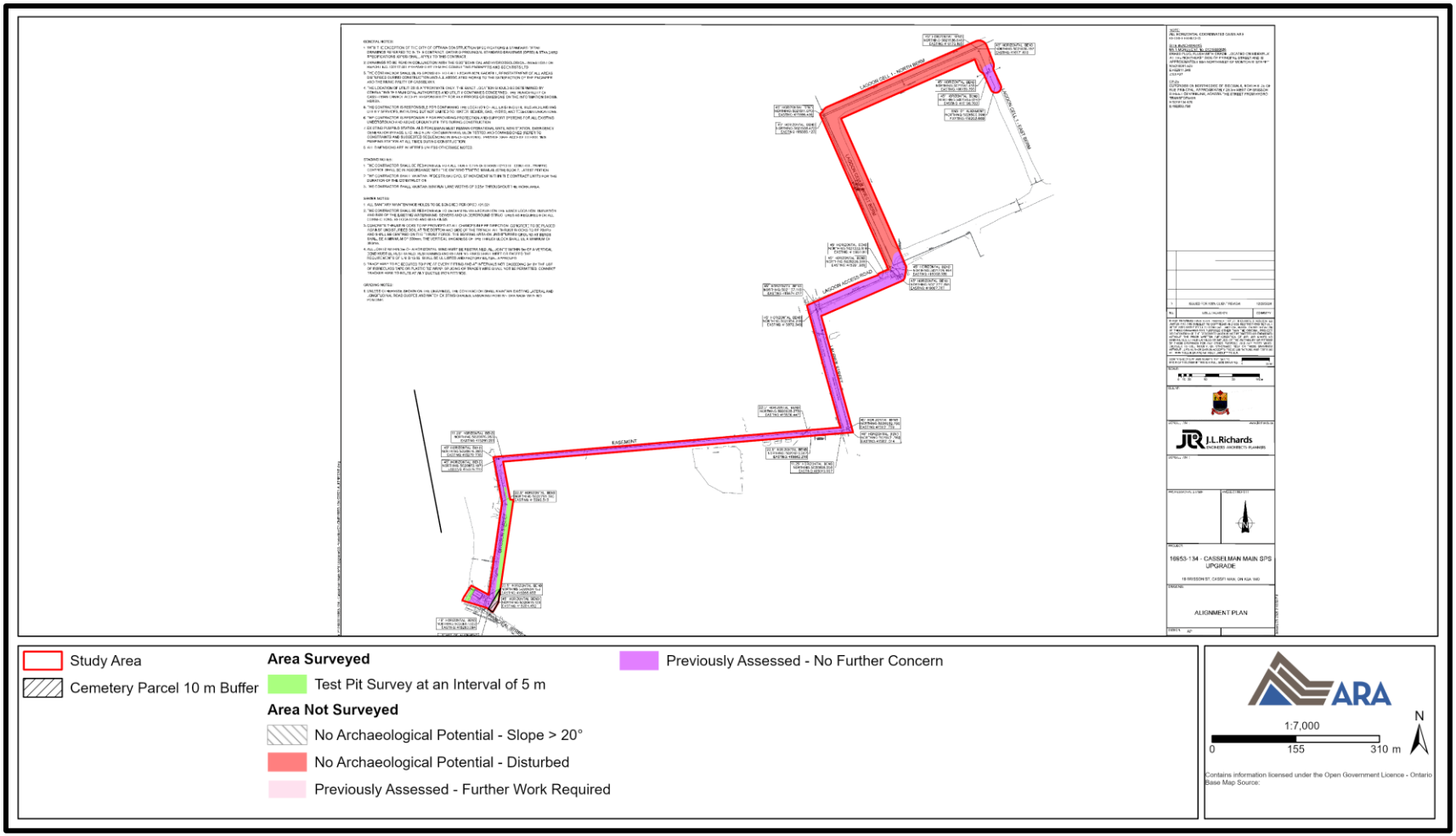
Map 8: Brisson J. Farm Cemetery (Legal Property)
(Courtesy of Municipality of Casselman)



Map 9: Features of Potential
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 10: Results (Aerial)
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 11: Results (Development Plan)
(Produced under licence using ArcGIS® software by Esri, © Esri)

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9.0 APPENDICES

Appendix A: AOPFN Culture and Heritage Artefacts and Sites Chance-Find Procedure

Casselman Main Sewage Pumping Station Upgrade

Corporation of the Village of Casselman

Attachment 3 – Cultural Heritage Assessment Report (CHAR)

ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

Cultural Heritage Assessment Report
Casselman Main SPS Upgrades
Municipalité de/Municipality of Casselman and Municipalité de/Municipality of The Nation
Lots 8-10, Concession 6
Geographic Township of Cambridge
United Counties of Prescott and Russell
Former Russell County

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HR-514-2024
ARA File # 2024-0031

REVISED
April 22, 2025

EXECUTIVE SUMMARY

Under a contract awarded in March 2024, Archaeological Research Associates, Ltd. carried out a Cultural Heritage Assessment Report for the Casselman Main Sewage Pumping Station Upgrade (henceforth, the "Project"). The project is needed to accommodate future projections for the Municipality of Casselman.

The purpose of this report is to identify any cultural heritage resources within and adjacent to the study area that may be directly or indirectly impacted by the proposed SPS upgrades and suggest mitigation measures for identified impacts. A combination of background research, site visit observations and selected consultation was used to inform the findings. The cultural heritage assessment was carried out in accordance with current best practices and requirements set out in the *Environmental Assessment Act*, R.S.O. 1990, *Planning Act* R.S.O. 1990, c. P.13, *Provincial Planning Statement* (2024), *Ontario Heritage Act*, R.S.O. 1990, c. O.18, the *Village of Casselman Official Plan* (2008) and the *United Counties of Prescott and Russell Official Plan* (2022).

The study area consists of an irregular shaped parcel of land with an area of 3.99 ha in size. The corridor-like study area runs from the east bank of the South Nation River at the Principale Street bridge, runs northward up Brisson St, turns leads easterly through agricultural lands to Laurier Street and further east into the lagoon area in the Town of Casselman, Ontario, consisting of parkland, farm fields, roadways and municipal infrastructure. The study area runs through roadways, pathways and some right-of-ways adjacent to various properties along the corridor including fallow agricultural fields, natural areas, a park and Conservation Area.

The Cultural Heritage Assessment Report approach included:

- Background research concerning the project and historical context of the study area;
- Identification of any designated or recognized properties within and adjacent to the study area;
- On-site inspection and creation of an inventory of all properties with potential Cultural Heritage Resources within and adjacent to the study area;
- A description of the location and nature of potential cultural heritage resources;
- Thumbnail description of each potential cultural heritage resource against the criteria set out in Ontario Regulation 9/06 (as amended by Ontario Regulation 569/22) for determining cultural heritage value or interest;
- Evaluation of potential project impacts; and
- Provision of suggested strategies for the future conservation of identified cultural heritage resources.

As a result of consultation with the Ministry of Citizenship and Multiculturalism, the Ontario Heritage Trust, and municipal staff, background research, existing heritage considerations and the field survey, five Cultural Heritage Resources were identified adjacent to the study area.

This report was initially drafted at preliminary planning phase in October 2024, the project has since progressed to 99%. While the trajectory of the corridor was adjusted in the northeast area with the lagoons, the project location remained within the October 2024 heritage assessed area and did not require further assessment. It is now noted that the location and scale of the proposed development did not change, the direct and indirect impacts remain the same based on the new development plan. The location/proposed design was not modified and the impacts were not

revised, this report was revised to reflect the 99% phase of the proposed plans. No addendum to this report was needed.

- As a result of this CHAR, the following mitigation strategies are recommended that: Any proposed construction staging areas should avoid the use of land associated CHR1-5.
- During construction, it is recommended that construction fencing be installed to protect CHR3-5. The fencing should place along the lot line and be maintained throughout the duration of the construction period.
- CHR5 J. Brisson Farm Cemetery, in particular, should be avoided by construction staging, trench digging, infrastructure installation, road reconstruction and any type of ground disturbance . As per the Stage 1 Archaeological Assessment, a cemetery investigation must also be carried out in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO.
- The proposed development has the potential to impact the natural landscape (i.e., the loss of trees or vegetation or crops changes to both the natural and agricultural characters of the study area).
- Public consultation may result in additional potential cultural heritage resources being identified. These potential cultural heritage resources should be reviewed by a qualified heritage consultant to: 1) determine their CHVI, 2) evaluate potential project impacts, and 3) suggest strategies for future conservation of any candidate cultural heritage resources.
- That previously-unrecognized Cultural Heritage Landscapes or Built Heritage Resources that possess potential cultural heritage value or interest discussed in this report *may* be worthy of inclusion on the municipality's *Register of Properties of Cultural Heritage Value or Interest*.
- This report should be provided to staff/planners at the municipal and regional level.
- That a Stage 1 archaeological assessment has been completed, concluding with a recommendation that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 *S&Gs*. No soil disturbing activities should take place until all archaeological concerns are mitigated and all reports are accepted by MCM.
- That should the facility improvement activities or the project location expand beyond the scope examined in this report, a qualified heritage consultant should be retained to determine the potential impacts and suggest mitigation measures.

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ABBREVIATIONS

ARA – Archaeological Research Associates Ltd.
BHR – Built Heritage Resource
CHER – Cultural Heritage Evaluation Report
CHL – Cultural Heritage Landscape
CHVI – Cultural Heritage Value or Interest
CHR – Cultural Heritage Resource
EA – Environmental Assessment
HIA – Heritage Impact Assessment
HSMBC – Historic Sites and Monuments Board of Canada
MHSTCI – Ministry of Heritage, Sport, Tourism and Culture Industries
OHA – Ontario Heritage Act
OHT – Ontario Heritage Trust
O. Reg. – Ontario Regulation
PPS – Provincial Planning Statement

PERSONNEL

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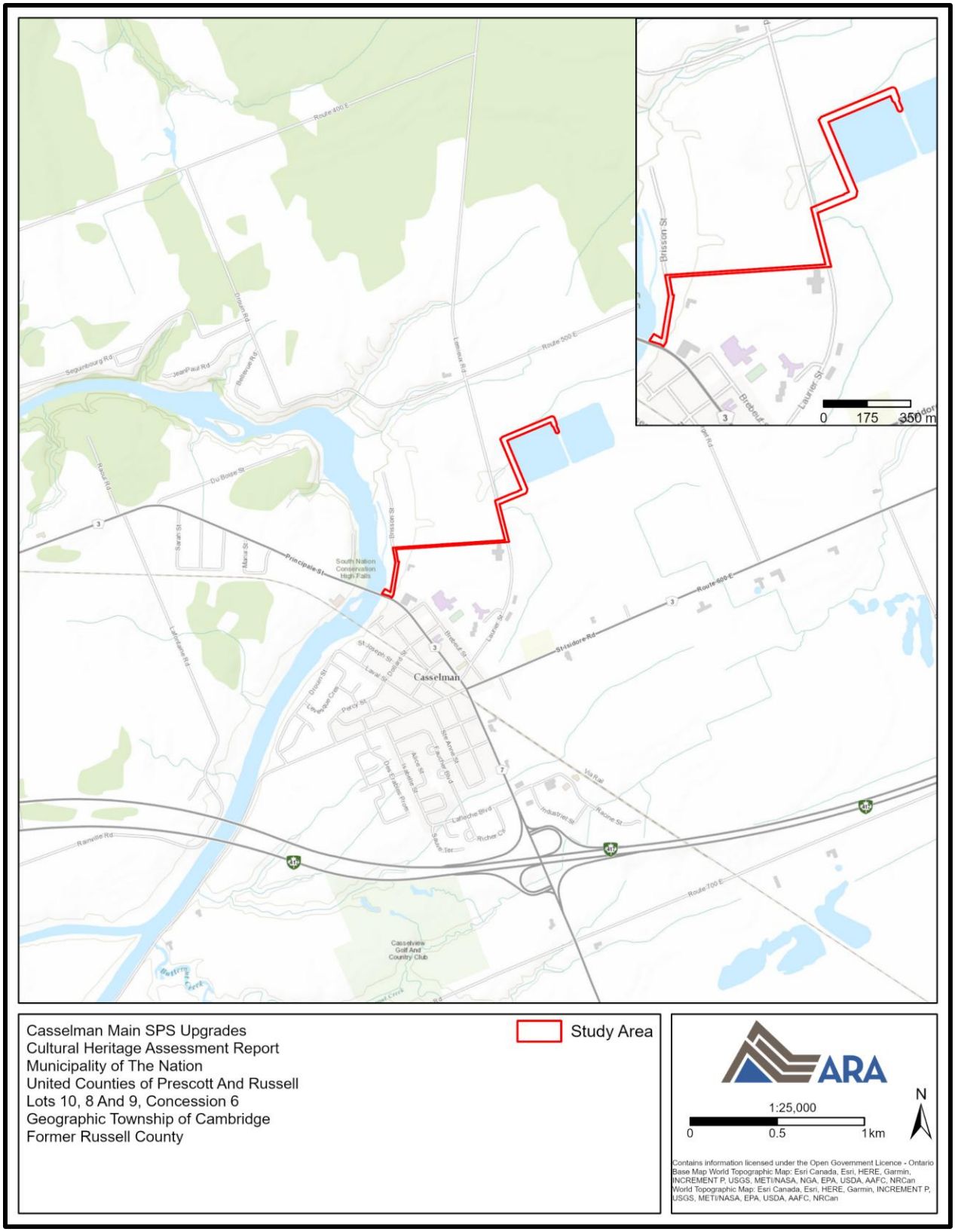
1.0 PROJECT CONTEXT

Under a contract awarded in March 2024, Archaeological Research Associates, Ltd. (ARA) carried out a Cultural Heritage Assessment Report (CHAR) for the Casselman Main Sewage Pumping Station Upgrade (henceforth, the "Project"). The project is needed to accommodate future projections for the Municipality of Casselman.

ARA conducted an assessment to identify known or potential cultural heritage resources (CHR)in or adjacent to the study area. The study area is 1.46 ha (3.61 ac) in size and is located on Lots 8-10, Concession 6 in the Municipality of Casselman and the Municipality of The Nation, Geographic Township of Cambridge, United Counties of Prescott and Russell (see Map 1 and Map 2). The property parcels along and adjacent to this area were assessed as a part of this CHAR.

For the purposes of this report, a CHR can be either a Built Heritage Resource (BHR) or a Cultural Heritage Landscape (CHL). No archaeological resources are being assessed within this report.

The purpose of this report is to identify any cultural heritage resources within and adjacent to the study area that may be directly or indirectly impacted by the proposed SPS upgrades and suggest mitigation measures for identified impacts. A combination of background research, site visit observations and selected consultation was used to inform the findings. The cultural heritage assessment was carried out in accordance with current best practices and requirements set out in the *Environmental Assessment Act*, R.S.O. 1990, *Planning Act* R.S.O. 1990, c. P.13, *Provincial Planning Statement* (2024), *Ontario Heritage Act*, R.S.O. 1990, c. O.18, the *Village of Casselman Official Plan* (2008) and the *United Counties of Prescott and Russell Official Plan* (2022).



Map 1: Study Area – Municipality of Casselman and Municipality of The Nation
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri)

Map 2: Aerial Image Showing the Study Area
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri)

2.0 LEGISLATIVE AND POLICY REVIEW

The framework for this assessment report is provided by federal guidelines, provincial planning legislation and policies as well as the Official Plan and guidelines.

2.1 Federal Guidelines

At the national level, *The Standards and Guidelines for Conservation of Historic Places in Canada* (Parks Canada 2010) provides guidance for the preservation, rehabilitation, and restoration of historic places, including cultural heritage landscapes (CHLs) and built heritage resources (BHRs). Such guidance includes the planning and implementation of heritage conservation activities.

2.2 Provincial Policies and Guidelines

2.2.1 Environmental Assessment Act and Guideline

Within the *Environmental Assessment Act,* the environment includes "any building, structure, machine or other device or thing made by humans." An Environmental Assessment (EA) is a study that evaluates the potential positive and/or negative effects of a project on the environment. This study is conducted as part of a streamlined EA process known as a Municipal Class EA (MCEA), which applies to routine projects grouped into classes that range from A (minor undertakings) to C (new construction of large facilities). The MCEA applies to municipal infrastructure undertakings including roads, water, and wastewater projects.

The *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessmoents* indicates a need to describe the "affected environment" that is "a spatially defined area within which land will be altered as a result of the proponent's development" (MCM 1992:3). As such, ARA completes in-depth research and evaluation of any potential cultural heritage resource within the study area. ARA's business practice also considers the study area and any adjacent properties. This ensures that every BHR and CHL that may be subject to potential indirect project impacts is identified.

2.2.2 The Planning Act:

Section 2 of the Ontario *Planning Act* indicates that a council of a Municipality have regard for matters of provincial interest such as: "(d) the conservation of features of significant architectural, cultural, historical, archaeological or scientific interest" (Government of Ontario 1990). Section 3 of the *Planning Act* directs a municipal Council's decisions to be consistent with the *Provincial Planning Statement* (PPS 2024).

2.2.3 Provincial Planning Statement (2024)

The Provincial Planning Statement (PPS 2024) contains a combined statement of the Province's land use planning policies. It provides the provincial government's policies on a range of land use planning issues.

The PPS 2024, which is enforced as of October 20, 2024, promotes the conservation of cultural heritage resources through detailed polices in Section 4.6, such as 4.6.1 "*Protected heritage property*, which may contain *built heritage resources or cultural heritage landscapes*, shall be *conserved*" and 4.6.3 "Planning authorities shall not permit development and site alteration on

adjacent lands to protected heritage property unless the heritage attributes of the protected heritage property will be conserve" (MMAH 2024:28).

Further, 4.6.5 b) notes "Planning authorities are encouraged to develop and implement: b) proactive strategies for conserving significant built heritage resources and cultural heritage landscapes" (MMAH 2024:28)

2.2.4 Ontario Heritage Act

The Ontario Heritage Act, R.S.O. 1990, c.018 is the guiding piece of provincial legislation for the conservation of significant cultural heritage resources in Ontario. The *OHA* gives provincial and municipal governments the authority and power to conserve Ontario's heritage. The Act has policies which address individual properties (Part IV), heritage districts (Part V), and allows municipalities to create a register of non-designated properties which may have cultural heritage value or interest (Section 27).

In order to objectively identify cultural heritage resources, Ontario Regulation (O. Reg) 9/06 (as amended by O. Reg 569/22) made under the *OHA* sets out nine principal criteria for determining cultural heritage value or interest (CHVI) (MCM 2006a:20–27). The criteria set out in the regulation were developed to identify and evaluate properties for designation under the *OHA*. Best practices in evaluating properties that are not yet protected employ O. Reg. 9/06 to determine if they have CHVI. These nine criteria are:

1. *The property has design value or physical value because it is a rare, unique, representative or early example of a style, type, expression, material or construction method,*
2. *The property has design value or physical value because it displays a high degree of craftsmanship or artistic merit, or*
3. *The property has design value or physical value because it demonstrates a high degree of technical or scientific achievement.*
4. *The property has historical value or associative value because it has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community,*
5. *The property has historical value or associative value because it yields, or has the potential to yield, information that contributes to an understanding of a community or culture, or*
6. *The property has historical value or associative value because it demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community.*
7. *The property has contextual value because it is important in defining, maintaining, or supporting the character of an area,*
8. *The property has contextual value because it is physically, functionally, visually or historically linked to its surroundings, or*
9. *The property has contextual value because it is a landmark.* O. Reg. 569/22, s. 1 (2).

A property must meet at least two of the above criteria in order to have CHVI. An *OHA* designation provides the strongest heritage protection available for conserving cultural heritage resources.

2.3 Municipal Policies

2.3.1 Official Plan for the United Counties of Prescott and Russell (UCPR)

Prescott and Russell are comprised of eight local municipalities including the Nation Municipality and the Municipality of Casselman, both of which are within the study area. While the Municipality of Casselman has its own OP with relevant policies summarized below in Section 2.3.2, below in the Nation Municipality uses the UCPR OP. As part of the Implementation component of the *United Counties of Prescott and Russel Official Plan* (202)2, Section 7.7 "Cultural Heritage Policies" contains policies specifically focused on cultural heritage resource conservation. With respect to conservation of cultural heritage resources throughout the Counties, Section 7.7 indicates that UCPR Council shall:

- *protect cultural heritage resources within their jurisdiction by using the Ontario Heritage Act for designation or conservation agreements;*
- *establish and keep a municipal register…; and*
- *establish a municipal heritage committee that will advise local council on heritage matters* (UCPR 2022:211).

In addition to a municipal register, the UCPR intends to keep a cultural heritage resource database which is to result in inventories of "significant heritage buildings, heritage districts, cultural heritage landscapes, archaeological sites, archaeological potential areas located within the County" (UCPR 2022:146). The *Official Plan for the United Counties of Prescott and Russell* (2022:146) indicates the UCPR shall ensure that lower tier municipalities' official plans have 'policies consistent with the heritage policies developed in the County official plan." Additionally, the OP indicates that:

> *Council shall require that identified heritage resources not yet listed in the municipal heritage register or Heritage Register are evaluated and conserved, as appropriate, through any legislated planning or assessment processes, including the Planning Act, the Environmental Assessment Act, the Ontario Heritage Act and the Cemeteries Act* (2022:212).

Policies are provided for the promotion of cultural heritage (subsection 7.7.3), cultural resources and waterfront development (subsection 7.7.4), accessibility and heritage conservation (subsection 7.7.5), waste reduction/adaptive reuse (subsection 7.7.6), energy efficiency and heritage conservation (7.7.7), property maintenance and occupancy standards by-law (7.7.8) and the Algonquins of Ontario, their connection with areas within the County and their input/participation in the archaeological assessment process (subsection 7.7.9).

The County outlines that cultural heritage resources are to include, but not be restricted to:

> *…significant built heritage, cultural significant heritage landscapes, archaeological sites, cemeteries and burials, buildings and structural remains of historical and architectural value, and human-made rural, village and urban districts or landscapes of historic and scenic interest* (UCPR 2022:213).

Archaeology is further addressed through policies under subsection 7.7.2 (Archaeological and Heritage Planning), subsection 7.7.2.1 (Archaeological Assessments) and subsection 7.7.2.2 (Marine Archaeological Resources).

2.3.2 Village of Casselman Official Plan

With respect to cultural heritage, Section 7.6.4 Heritage Conservation within *Village of Casselman Official Plan* (Municipality of Casselman 2008:90) begins by stating:

> *Council shall maintain a cultural heritage resource database and/or heritage management plans for land use planning, resulting in inventories of significant heritage buildings, heritage districts, cultural heritage landscapes, archaeological sites, and archaeological potential areas within the Village".*

The Village of Casselman indicates that they seek to conserve and mitigative potential impacts to cultural heritage resources such that:

> *A heritage impact assessment may be required if there are any adverse impacts to any significant cultural heritage resources resulting from development proposals. Mitigative measures and/or alternative development approaches may be required for the conservation of heritage attributes of a protected heritage property* (Municipality of Casselman 2022:90-91).

Additionally, the Township OP provides direction concerning the preservation of archaeological resources.

2.4 Policy Conclusions

Policies in the *Prescott Russell Official Plan* and the *Village of Casselman Official Plan* call for the conservation of cultural heritage resources, the maintaining of heritage registers or database and provide policies related to potential development impacts to cultural heritage resources. This CHAR will be conducted in conformity with these policies as they relate to the proposed project.

3.0 KEY CONCEPTS

The following concepts require clear definition in advance of the methodological overview and proper understanding is fundamental for any discussion pertaining to cultural heritage resources:

- **Adjacent Land** means for the purposes of policy 4.6.3, those lands contiguous to a protected heritage property or as otherwise defined in the municipal official plan (MMAH 2024:38).
- **Cultural Heritage Value or Interest** (CHVI), also referred to as Heritage Value, is identified if a property meets two of the criteria outlined in O. Reg. 9/06 namely historic or associate value, design or physical value and/or contextual value. Provincial significance is defined under *Ontario Heritage Act (OHA) O. Reg*. 10/06.
- **Built Heritage Resource** (BHR) can be defined in the *PPS* as: "a building, structure, monument, installation or any manufactured or constructed part or remnant that contributes to a property's cultural heritage value or interest as identified by a community, including Indigenous community." (MMAH 2024:40).
- **Conserved** means "the identification, protection, management and use of built heritage resources, cultural heritage landscapes and archaeological resources in a manner that ensures their cultural heritage value or interest is retained. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment, and/or heritage impact assessment that has been approved, accepted or adopted by relevant planning authority and/or decision-makers. Mitigative measures and/or alternative development approaches can be included in these plans and assessments" (MMAH 2024:41).
- **Cultural Heritage Landscape** (CHL) is defined in the *PPS* as: "a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Indigenous community. The area may include features such as buildings, structures, spaces, views, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association" (MMAH 2024:41).
- **Heritage Attributes** are defined in the *PPS* as: "defined under the Ontario Heritage Act, in relation to real property, and to the building and structures on the real property, the attributes of the property, buildings and structures that contribute to their cultural heritage value or interest" (MMAH 2024:44).
- **Protected heritage property** is defined as "means property designated under Part IV or VI of the Ontario Heritage Act; property included in an area designated as a heritage conservation district under Part V of the Ontario Heritage Act; property subject to a heritage conservation easement or covenant under Part II or IV of the Ontario Heritage Act; property identified by a provincial ministry or a prescribed public body as a property having cultural heritage value or interest under the Standards and Guidelines for the Conservation of Provincial Heritage Properties; property protected under federal heritage legislation; and UNESCO World Heritage Sites." (MMAH 2024:50).
- **Significant** in reference to cultural heritage is defined as: "resources that have been determined to have cultural heritage value or interest. Processes and criteria for determining cultural heritage value or interest are established by the Province under the authority of the Ontario Heritage Act" (MMAH 2024:52).

The Official Plan for the UCPR defines relevant key concepts as follows:

- **Cultural Heritage Resources** are defined in the UCPR OP as: "include[ing], but not restricted to, significant built heritage, significant cultural heritage landscapes,

archaeological sites, cemeteries and burials, buildings and structural remains of historical and architectural value, and human-made rural, village and urban districts or landscapes of historic and scenic interest" (UCPR 2022:213).

4.0 HISTORICAL CONTEXT

Historic research for the project was completed using secondary sources. Additional background information was also obtained from aerial photographs, historical maps (i.e., illustrated atlases), archival sources (i.e., historical publications and records), and published secondary sources (online and print).

4.1 A Note on the Pre-Colonial Landscape

Prior to the rise in development of the 19th and 20th centuries, the landscape of the United Counties of Prescott and Russel would have looked very different than what exists today. Situated within the watershed of the Ottawa River, specifically along its South Nation River tributary, the lush and thriving environment would have held great importance to past Indigenous peoples, who would sustain themselves on the abundant flora and fauna of the area. There is well-established Anishinaabe and Algonquin history in the Ottawa River watershed (Morrison et al. 2015) and the South Nation River itself (Larose 1947).

Unfortunately, colonialism and widespread development largely dispossessed Indigenous peoples of their traditional lands. Despite their intentions to “share the land”, European concepts of land ownership divorced First Nations and Indigenous communities from their long-held role as stewards over the land and decision-making about environmentally significant locations were effectively removed from their control. Today, it is necessary to recognize the importance that the land once held for past Indigenous peoples and the push of their descendants for a return to stewardship over the remaining, but diminishing, examples of natural locations, particularly in southern Ontario. Although this area has been extensively farmed, city-like urban sprawl has not yet achieved the levels of growth and impact as it has elsewhere.

4.2 Pre-Contact

The United Counties of Prescott and Russell have a long history of Indigenous land use and settlement including Pre-Contact and Post-Contact campsites and villages. It should be noted that the written historical record regarding Indigenous use of the landscape in Eastern Ontario draws on accounts by European explorers and settlers. As such, this record only details a small period of time in the overall human presence in Ontario. Oral histories and the archaeological record show that Indigenous communities were mobile across great distances, which transcend modern understandings of geographical boundaries and transportation routes.

After decades of archaeological work in eastern Ontario, scholarly understanding of the historical usage of the area has developed significantly. With occupation beginning in the Late Palaeo-Indian period approximately 10,000 years ago, the greater vicinity of the study area comprises a complex chronology of Indigenous and Euro-Canadian histories. The following sections summarize the region’s settlement history and documents the study area’s past and present land uses.

The Pre-Contact history of the region is lengthy and rich, and a variety of Indigenous peoples inhabited the landscape. This location was used and shared by many since time immemorial, each with their own traditions as to how they arrived, how they lived, and the major events that marked their time here. There is no singular way to tell this story. Alongside the brief historical narrative as understood by heritage professionals, at the time of writing, some First Nations and Indigenous communities have provided traditional knowledge regarding their history, community, and story for inclusion in reports. It should be noted that one Nation’s traditional knowledge does

not necessarily reflect the views of another Nation or the consultant. These histories are outlined below in Table 1.

The earliest documented evidence of occupation in southern Ontario dates to around 13,000 BC, after the retreat of the glaciers and the formation of the early lakes. At that time, small bands of Indigenous peoples moved into the region, leading mobile lives based on communal hunting of large game and the collection of plant-based food resources. During this period, which is referred to by archaeologists as the Palaeo period, Indigenous peoples ranged over very wide territories in order to live sustainability in a post-glacial environment.

Around 7500 BC, the climate warmed and deciduous forests appeared. The Indigenous peoples adapted their hunting practices and tools to better suit the new animal and plant food sources. This change in material cultural is referred to as the Archaic period. Populations increased in size and Indigenous peoples began to participate in long-distance trade.

The Woodland period is marked by the appearance of ceramic pottery, which is noted around 900 BC. The first evidence of maize (corn) horticulture in southern Ontario appears around AD 900, as small circular or square houses begin to appear. Overtime, the practice of maize horticulture improved, allowing for population increases, larger settlement sizes, and increased social complexity in villages. These developments are linked to the spread of Iroquoian-speaking populations, including the ancestors of the historically-documented Wendat, Attawandaron, and Haudenosaunee nations. Algonquin-speaking populations, including the Anishinaabeg, also represented a significant presence in southern Ontario and were less agriculturally-oriented. As a result, archaeological evidence of their presence can be sometimes elusive. Nevertheless, this part of southern Ontario represents the ancestral territory of various Indigenous peoples, each with their own land use patterns and cultural traditions.

By the time of the arrival of the Europeans, villages were large and populous, with distinct cultures represented archaeologically. The end of the Woodland period is cited around AD 1600, with the spread of the fur trade which resulted in substantial changes to Indigenous lifeways, including the rise in use of items of European manufacture. Increased contract with Europeans resulted in the introduction of diseases to the Indigenous communities and decreases in their population.

Table 1: Huron-Wendat Nation History
(As provided by the Huron-Wendat Nation)

Huron_Wendat Nation History
As an ancient people, traditionally, the Huron-Wendat, a great Iroquoian civilization of farmers and fishermen-hunter-gatherers and also the masters of trade and diplomacy, represented several thousand individuals. They lived in a territory stretching from the Gaspé Peninsula in the Gulf of Saint Lawrence and up along the Saint Lawrence Valley on both sides of the Saint Lawrence River all the way to the Great Lakes. Huronia, included in Wendake South, represents a part of the ancestral territory of the Huron-Wendat Nation in Ontario. It extends from Lake Nipissing in the North to Lake Ontario in the South and Île Perrot in the East to around Owen Sound in the West. This territory is today marked by several hundred archaeological sites, listed to date, testifying to this strong occupation of the territory by the Nation. It is an invaluable heritage for the Huron-Wendat Nation and the largest archaeological heritage related to a First Nation in Canada. According to our own traditions and customs, the Huron-Wendat are intimately linked to the Saint Lawrence River and its estuary, which is the main route of its activities and way of life. The Huron-Wendat formed alliances and traded goods with other First Nations among the networks that stretched across the continent. Today, the population of the Huron-Wendat Nation is composed of more than 4000 members distributed on-reserve and off-reserve. The Huron-Wendat Nation band council (CNHW) is headquartered in Wendake, the oldest First Nations community in Canada, located on the outskirts of Quebec City (20 km north of the city) on the banks of the Saint

Huron_Wendat Nation History
Charles River. There is only one Huron-Wendat community, whose ancestral territory is called the Nionwentsïo, which translates to "our beautiful land" in the Wendat language. The Huron-Wendat Nation is also the only authority that have the authority and rights to protect and take care of her ancestral sites in Wendake South.

4.3 Post Contact Settlement History

The arrival of European explorers and traders at the beginning of the 17th century triggered widespread shifts in Indigenous lifeways and set the stage for the ensuing Euro-Canadian settlement process. Documentation for this period is abundant, ranging from the first sketches of Upper Canada and the written accounts of early explorers to detailed township maps and lengthy histories. The Post Contact period can be effectively discussed in terms of major historical events, and the principal characteristics associated with these events are summarized in Table 2.

Table 2: Post-Contact Settlement History
(Smith 1846; Coyne 1895; Lajeunesse 1960; Cumming 1972; Ellis and Ferris 1990; JHA 1993; Surtees 1994; ORHDC 2005; AO 2023)

Historical Event	Timeframe	Characteristics
Early Exploration	Early 17th century	Brûlé explores southern Ontario in 1610/11; Champlain travels through in 1613 and 1615/1616, making contact with a number of Indigenous groups (including the Algonquin, Huron-Wendat and other First Nations); European trade goods become increasingly common and begin to put pressure on traditional industries; Names of bands suggest that Algonquin territorial organization was based on watersheds; Nipissings and Algonquins were involved in inter-tribal trade
Increased Contact and Conflict	Mid- to late 17th century	Conflicts between various First Nations during the Beaver Wars result in numerous population shifts; Nipissings and Algonquins tended to avoid the lower Ottawa in the summer due to Iroquois attacks; European explorers continue to document the area, and many Indigenous groups trade directly with the French and English; 'The Great Peace of Montreal' treaty established between roughly 39 different First Nations and New France in 1701
Fur Trade Development	Early to mid-18th century	Growth and spread of the fur trade; Bands of the Algonquin Nation occupied the Ottawa Valley; Many spent their summers at mission villages; Peace between the French and English with the Treaty of Utrecht in 1713; Ethnogenesis of the Métis; Hostilities between French and British lead to the Seven Years' War in 1754; French surrender in 1760; Loss of Algonquin hunting territories as the British seized France's colonies
British Control	Mid- to late 18th century	*Royal Proclamation* of 1763 recognizes the title of the First Nations to the land; Algonquins and Nipissings attended the Niagara Treaty Council; Numerous treaties subsequently arranged by the Crown; First land cession under the new protocols is the Seneca surrender of the west side of the Niagara River in 1764; The Niagara Purchase (Treaty 381) in 1781 included this area
Loyalist Influx	Late 18th century	United Empire Loyalist influx after the American Revolutionary War (1775–1783); British develop interior communication routes and acquire additional lands; Crawford's Purchases completed in 1783 to provide land for the Loyalists; *Constitutional Act* of 1791 creates Upper and Lower Canada
County Development	Late 18th to early 19th century	Became part of Stormont County in 1792; Russell County established in 1798 from the northern part of Stormont County; Comprised the Townships of Cambridge, Clarence, Cumberland and Russell; Initial settlement was slow due to the agricultural inferiority of the soils; Russell County and Prescott County united in 1820 for the purposes of Parliamentary representation; They remain united to this present day; Independent after the abolition of the district system in 1849

Historical Event	Timeframe	Characteristics
Township Formation	Late 18th to mid-19th century	Surveyed in 1791 by James Rankin; First patents were granted in 1796 to Loyalists, including Col. Rankin, Col. Brewerton and the Jessup brothers who were granted 5,000 acres each; Other Loyalists and ex-officers received smaller parcels; Approximately half of the township was held by ex-officers, though they were non-residents; Settlement in the township began in the early 1800s; Settlement was slow due to lack of accessibility; First settler was Martin Casselman ca. 1830; Casselman built a shack near the rapids of South Nation River on land owned by Major Jessup; In 1843 Casselman bought 1,000 acres from Jessup including the land around the rapids to construct a dam and sawmill; A few Scots settled in the 1830s and 1840s, including the McRae, McKinnon and Ferguson families, followed by French Canadians
Township Development	Mid-19th to early 20th century	Population reached 102 by 1842; 1,164 ha taken up by 1846, with 65 ha under cultivation; 4,370 ha of Crown lands open for sale; 1 sawmill in operation at that time; Traversed by the Nation River (South Nation River); Communities at Mayerville, St. Albert and Casselman

Between 1815 and 1824, heavy immigration from the Old World resulted in the doubling of the non-Indigenous population of Upper Canada from 75,000 to 150,000. This dramatic increase was a result of the outcome of the War of 1812 and the Crown's efforts to populate the province's interior (Surtees 1994). In earlier the Royal Proclamation of 1763, the British government recognized the title of the First Nations to the land they lived in and used. This meant that the land had to be purchased by the Crown from the First Nations before it could be used for European settlement. Subsequently, numerous treaties were arranged by the British and large swaths of territory were acquired. Today, it is understood that the Crown and Indigenous peoples had very different ideas about what the treaties represented. For the Crown, the treaties were usually viewed as complete land surrenders, paving the way for immigration and settlement. For First Nations and Indigenous communities, on the other hand, treaties were viewed as agreements to share the land as equal parties. However, with the subsequent influx of immigration and growing number of non-Indigenous settlers, their ability to sustain their traditional lifeways and adequately share the land was no longer a possibility.

The subject lands in question comprise part of the area subject to the 1783 Crawford Purchase, an agreement between the Mississaugas and the British. They also fall within the proposed Algonquins of Ontario Settlement Area, a suggested resolution to a land claim that was submitted to the Crown by some Algonquins in 1983 and 1985, who view the land as unceded because they were not a signatory to the Crawford Purchase. Today, we recognize that the subject lands comprise part of the traditional territory of the Wendat (as represented by the Huron-Wendat Nation), the Haudenosaunee (as represented by the Mohawk Council of Akwesasne), and the Algonquins (as represented by the Algonquins of Ontario and other Algonquin nations).

The study area is located along the east side of the South Nation River, north of the historical village of Casselman. The study area lands consist of predominately parkland, open field, and surveyed roadways, and terminates at a series of sewage lagoons. The land use at the time of assessment can be classified predominately as parkland and agricultural in nature.

4.3.1 Village of Casselman

The village of Casselman begins with Martin Casselman, who visited the area in 1832 for a hunting trip on the shores of the South Nation River. He noted the abundant forest and envisioned the establishment of a village where he could exploit the forest resources and set-up a lumber business. In 1843, Martin purchased 1,600 acres of land that was bisected by the South Nation

River. With the help of 40 men, Casselman had a dam and sawmill constructed in 1844. These men were promised the sale of a piece of land at a low price. The town saw a boost in population in 1882 with the coming of the railway. Casselman suffered three fires within a short period. The first fire, in 1891, destroyed the sawmills and part of the village. The second fire occurred six years later in 1897 and destroyed the entire Casselman area and affected the nearby communities of Limoges and St. Albert. The third fire occurred years later in 1919 and destroyed many businesses along Rue Principale (Municipality of Casselman 2023a).

4.3.2 Coupal and Laplante Hydroelectric Stations

In 1908, a local businessman named J.N. Coupal began construction on a 140 m (460') dam across the South Nation River and an associated 125 kW powerhouse to provide electricity for his home, grist mill and neighbouring homes. The project was completed in 1910, and the village council granted a 30-year franchise to Coupal to supply electricity to the rest of the village. Coupal closed his grist mill in 1922, increasing the supply to the village as a result. By this time, demand had increased significantly, and some new residents were on two-year waiting lists to receive power.

A local power commission was formed in 1924 and a new 10-year contract was negotiated to supply power, part of which required that all surplus money be refunded to customers. The village resumed the terms of the 30-year contract after the 10-year contract expired. By 1952, the demand for electricity had increased beyond the capacity of Coupal's system and the village established a publicly managed utility called Casselman Hydro (CG 2024; HO 2024).

Coupal's plant ceased operations in the mid-1960s. In 1986, a new hydroelectric station was constructed by G. Laplante to provide power to roughly 75 customers in Casselman. This involved the blasting and excavation of a 5 m wide trench along the side of the river and the construction of a powerhouse only a few metres from Coupal's powerhouse. Casselman Hydro became part of the Hydro Ottawa family in May 2002 (HO 2024). Laplante's powerhouse was still in operation at the time of assessment, and the ruins of the Coupal plant are visible to the south.

4.3.3 Doran Park

Doran Park is located on the east bank of the South Nation River and is part of the High Falls Conservation Area (formerly known as the Casselman Conservation Reservoir). The conservation area itself spans both banks of the South Nation River (south of the weir built in 1966) and consists of 5.5 acres of parkland with barbeques, picnic facilities, a floating dock, a boat launch and other amenities. The area is well known for walleye and pike fishing, and fishing derbies are common. The ruins of J.N. Coupal's dam from 1910 are visible from the boundaries of the park (SNCA 2020b).

4.3.4 J. Brisson's Farm and Cemetery

According to the land transactions of the former church property, in 1944, the Trustees of the Casselman United Church (formerly the Presbyterian Church) sold the church property to David Valley. This sale excluded the cemetery lands, which remain under the ownership of the Trustees of the Congregation of South Casselman Village. A transcription of the 10 visible grave markers was undertaken in 1995 by the Ottawa Branch of the Ontario Genealogical Society, which were associated with the burials of 17 people (ARA 2024) The Bereavement Authority of Ontario was contacted regarding any records they may have regarding the cemetery, but no maps or surveys were on file. The cemetery operator (Municipality of Casselman) was able to provide one additional map, but this only shows the legal cemetery boundary. The cemetery is currently

inactive, and it remains unclear whether there are any unmarked burials within or beyond the current parcel.

The Cemetery on J. Brisson's Farm (CM-03449) comprises an unaddressed L-shaped property located between 806 and 810 Principale Street (Nation View Farm). The visible grave markers fall on the southeast side of the driveway leading to Nation View Farm. The cemetery has several alternate names, including J. Brisson's Farm Cemetery, Doran Farm Road Cemetery, Presbyterian Cemetery, Abandoned Cemetery and Brisson Farm Road Cemetery (OGS 2023). The name used by the Bereavement Authority of Ontario (BAO) has been adopted herein (BAO 2017).

4.4 Mapping and Imagery Analysis

In order to gain a general understanding of the study area, two historic settlement maps, a topographic map, and one aerial image were examined during the background research for the study. Specifically, the following resources were consulted:

- D.P. Putnam's *Map of the Counties of Stormont, Dundas, Glengarry, Prescott & Russell, Canada West* (1862) (OHCMP 2019);
- H. Belden & Co.'s *Prescott and Russell Supplement* in *The Illustrated Atlas of the Dominion of Canada* (1881) (MU 2001);
- A topographic map from 1908 (OCUL 2023); and
- An aerial image from 1954 (U of T 2023).

The limits of the study area are show on georeferenced versions of the consulted historical resources in Map 3– Map 6.

D.P. Putnam's *Map of the Counties of Stormont, Dundas, Glengarry, Prescott & Russell* (1862) indicates the study area spanned Lots 8, 9, and 10, Concession 6 within the Geographic Township of Cambridge. The west side of the study area is located on the east side of the South Nation River in Lot10, near a point in the river labelled as "High Falls" and runs north at a diagonal angle before cutting east-west across Lot 9 (see Map 3). The study area then cuts diagonally north again, following a historical road in Lot 8 before travelling east-west again across Lot 8, before terminating at the boundary between Lot 8 and Lot 7. Two lots, Lot 10 and Lot 8 do not have a landowner listed on the map, but Lot 9 was owned between J. McGillivary and M. Casselman. The study area was located in proximity to a mill, which is marked on the opposite side (west bank) of the South Nation River, and a historic thoroughfare and bridge crossed the river south of the mill and served as the south border of the west section of the study area, and another historic thoroughfare which also involves part of the study area. With the exception of the historic road, there are no historic structures, cemeteries, or commercial industries indicated within the boundaries of the study area, and the character of the area appears rural in nature.

The *Prescott and Russell Supplement* in *The Illustrated Atlas of the Dominion of Canada* (1881) indicates that the settlement of Casselman had developed around the area called "High Falls" on the South Nation River. The map shows a post office, but there does not appear to be much in the way of settlement or industrialization either within the boundaries of the study area or on adjacent properties, although there appears to be a series of structures on the west bank of the South Nation River (see Map 4). The map shows few changes from 1862, though the road alignments appear to have changed in the intervening 19 years. The study area still spanned Lots 10, 9, and 8 in Concession 6, and none of the lots had individual owners listed, nor were there any buildings located within the study area, although the study area did follow the route of a

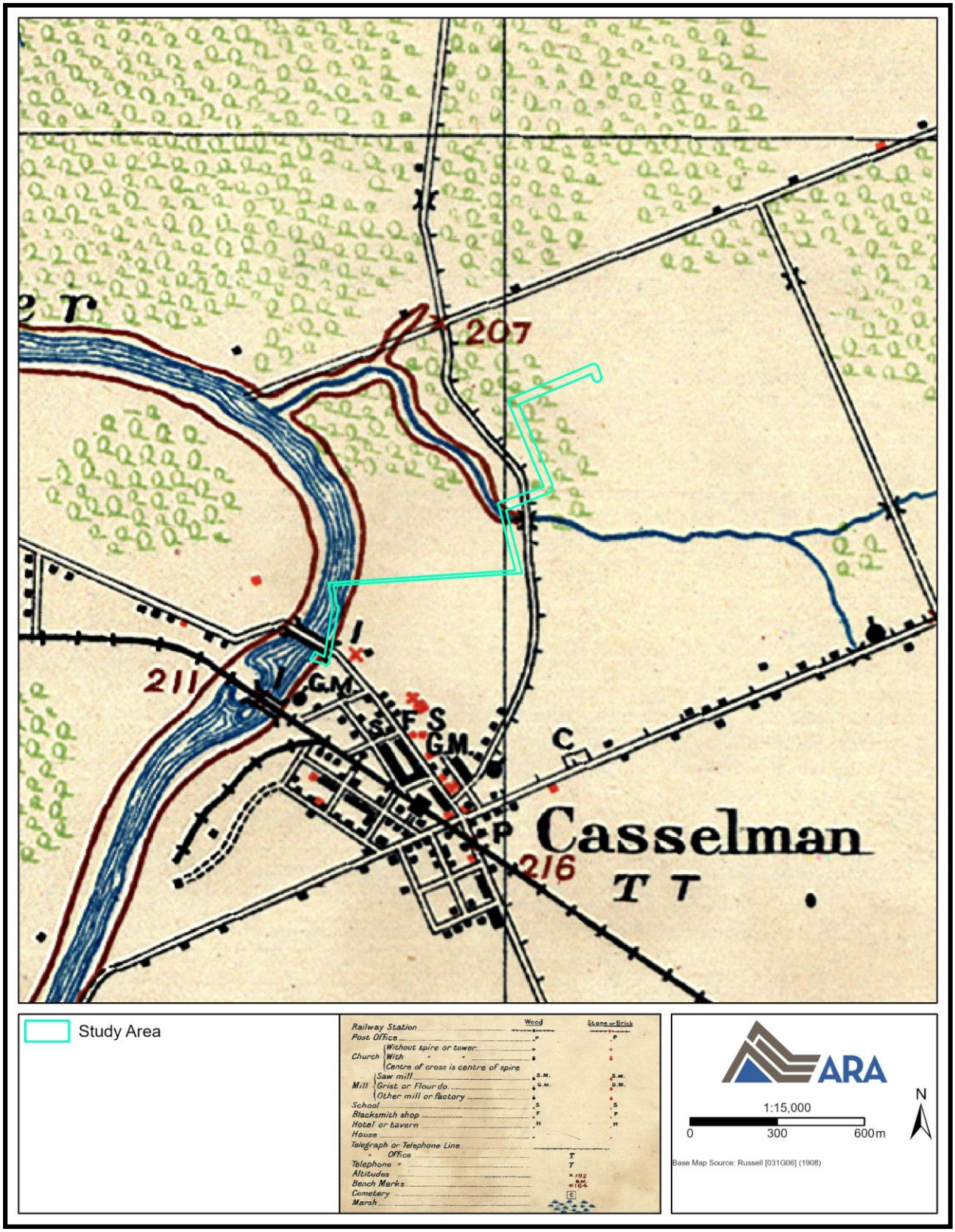
historic thoroughfare in Lot 9. The owners of surrounding lots included J.S. Casselman (500 acres), Martin Casselman (10,000 acres), and R.A. Casselman (400 acres), and a school was located to the south of the study area at the south boundary of Lot 8, on the north side of another historic road.

A topographic map from 1908 indicates that the study area was located to the north of the village of Casselman, which has grown significantly in size. The study area's west side runs parallel with the east bank of the South Nation River, before cutting east-west across open field and joining a historic road, where the study area turns to the north. It follows the road a short distance and crosses a creek or watershed before cutting east-west again across a woodlot and another open area (see Map 5). There are no buildings located in the study area. A bridge spans the South Nation River to the south of the study area's west boundary, and the structures marked on the west bank of the river in 1881 were not apparent in the 1906 map. J.M. Coupal's hydroelectric generating station had not yet been built at this time. A red "X" marks the location of an unnamed cemetery which appears on the topographic map near the intersection of Rue Principale Street and Brisson Street, and no other landmarks are located around the study area.

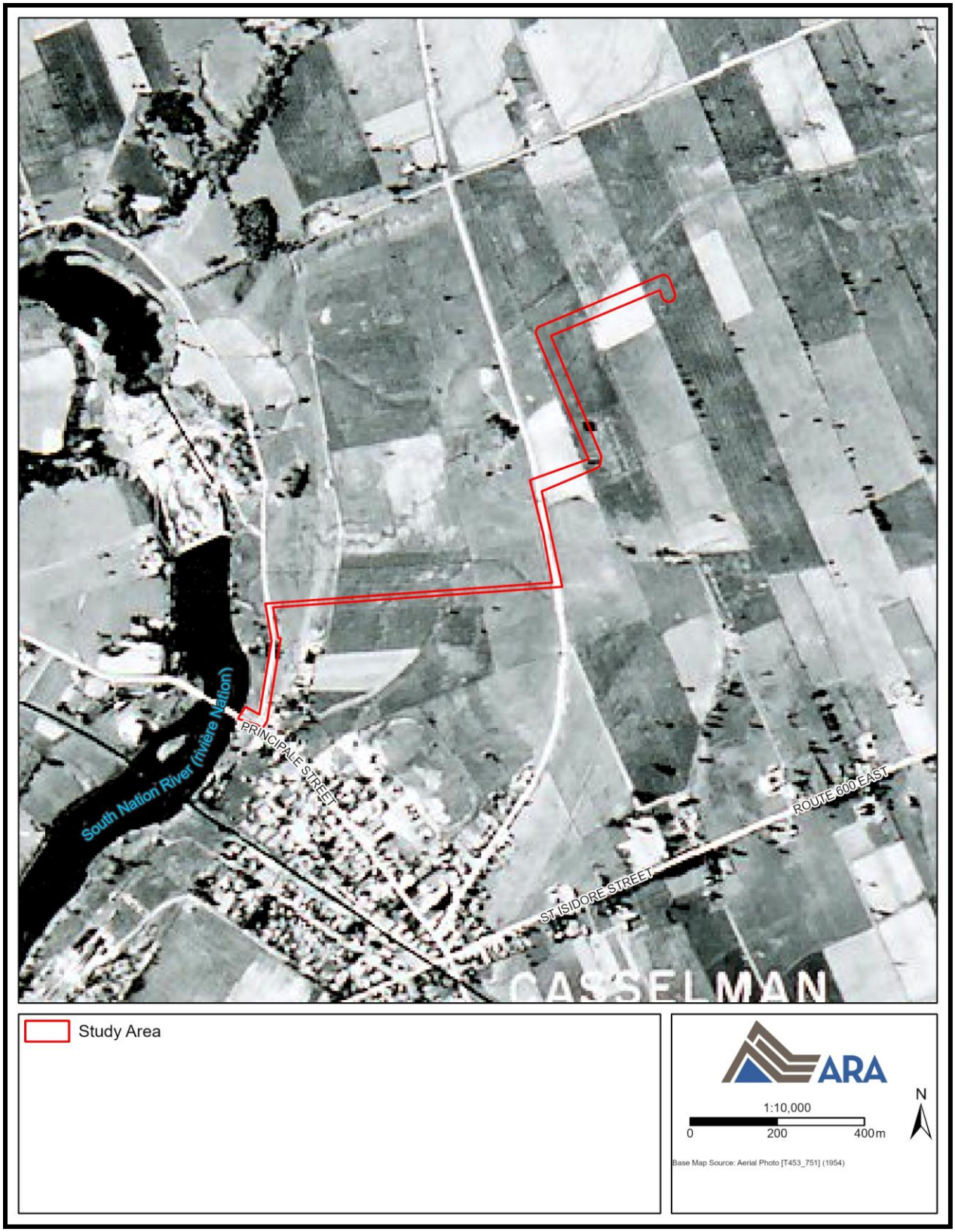
An aerial image of the study area from 1954 shows a well-settled village of Casselman in much the same configuration as the topographic map, with the layout of streets and bridges in roughly the same area. The Rue Principale Street bridge spans the South Nation River at the south boundary of the west side of the study area, and the study area itself appears to be predominately located on agricultural fields, although in two sections the study area also follows the route of an existing roadway (see Map 6). There does not appear to be any buildings located within the study area. Unlike the 1908 topographic map, J.N. Coupal's hydroelectric dam is clearly visible where it spanned the river. The area surrounding the larger village of Casselman remained rural in nature, comprised of agricultural fields, which includes the study area. The sewage lagoons seen in a modern aerial photograph in Map 2 had not been constructed at that time.

Map 3: Study Area on an 1862 Map
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri; OHCMP 2019)

Map 4: Study Area on an 1881 Map
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri; MU 2001)



Map 5: Study Area on a Topographic Map from 1908
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri; OCUL 2022)



Map 6: Study Area on an Aerial Image from 1954
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri; WU 2022)

5.0 CONSULTATION

BHRs and CHLs are broadly referred to as cultural heritage resources (CHRs). A variety of types of recognition exist to commemorate and/or protect cultural heritage resources in Ontario.

5.1 Federal

The Minister of the Environment and Climate Change, on the advice of the Historic Sites and Monuments Board of Canada (HSMBC), makes recommendations to declare a site, event or person of national significance. The National Historic Sites program commemorates important sites that had a nationally significant effect on, or illustrates a nationally important aspect of, the history of Canada. A National Historic Event is a recognized event that evokes a moment, episode, movement or experience in the history of Canada. National Historic People are people who are recognized as those who through their words or actions, have made a unique and enduring contribution to the history of Canada. There exists Parks Canada's online *Directory of Federal Heritage Designations* which captures these national commemorations. This directory also lists Heritage Railway Stations, Federal Heritage Buildings and Heritage Lighthouses. It is important to note that these federal commemoration programs do not offer protection from alteration or destruction. The *Federal Canadian Heritage Database* was searched, and no plaques or properties were noted within or adjacent to the study area (Parks Canada 2024a).

Another form of recognition at the federal level is the Canadian Heritage Rivers System program. It is a federal program to recognize and conserve rivers with outstanding natural, cultural and recreational heritage. Another form of recognition is the *Canadian Register of Historic Places* (2024b) which contains properties recognized by federal, provincial and territorial governments. It is important to note that federal commemoration or recognition programs do not offer protection from alteration or destruction. The subject property is not recognized on the Canadian Register of Historic Places, nor are any properties adjacent to the subject property.

5.2 Provincial

The Ontario Heritage Trust (OHT 2024a) operates the Provincial Plaque Program that has over 1,250 provincial plaques recognizing key people, places and events that shaped the province. None of the properties within the study area are recognized with provincial plaques.

Protected properties are those protected by Part IV (individual properties) or Part V (Heritage Conservation District) designation under the *OHA*. OHT's (2024b) list of Heritage Conservation Districts was consulted. None of the properties within the study area were found to be located within a designated district.

5.3 Municipal

At project commencement, ARA contacted the Municipality of Casselman, to inquire about heritage interests: 1) protected properties within or adjacent to the project location, 2) properties with other types of recognition in or adjacent to the project location, 3) previous studies relevant to the current study, and 4) other heritage concerns regarding the subject property and adjacent properties. ARA contacted the Municipality on June 18, 2024. The Director of Planning services replied that to their knowledge, there are no heritage concerns within or adjacent to the study area. It should be noted that ARA recently conducted a similar assessment for another project for the Municipality that falls partially within the subject study area, and have therefore incorporated those relevant CHRs within this report (ARA 2023).

6.0 EXISTING CONDITIONS

6.1 Field Survey

The field survey component of an assessment involves the collection of primary data through systematic photographic documentation of all potential CHRs within the study area, as identified through historical research and consultation. Generally, potential CHRs are identified by applying a 40-year rolling timeline. This timeline is considered an industry best practice (i.e., MTO 2008). A date of 40 years does not automatically attribute CHVI to a resource; rather, that it should be flagged as a potential resource and evaluated for CHVI. The purpose of this assessment is to identify and evaluate CHRs within the study area and identify any protected resources adjacent to the study area that may be impacted by the proposed undertaking.

Additional cultural heritage resources may also be identified during the survey itself. Photographs capturing all properties with potential BHRs and CHLs are taken, as are general views of the surrounding landscape. The field survey also assists in confirming the location of each potential CHR and helps to determine the relationship between resources. Given that such surveys are limited to areas of public access (i.e., roadways, intersections, non-private lands, etc.), there is always the possibility that obscured cultural heritage resources may be missed or that heritage attributes may be refined upon closer inspection.

The field survey was conducted on July 11, 2024, to photograph and document the study area and surrounding area. The archaeology field survey was conducted on June 15, 2024. A selection of photographs from both surveys are noted in this report. Legal permission to enter and conduct fieldwork activities on most of the study area, i.e., the parklands and the lagoon properties on either end of the study area, was granted by the municipality.

As a result of consultation, examination of existing recognition and research, 5 CHRs were identified adjacent to the study area that have met or have the potential to meet two or more O. Reg. 9/06 criteria. Their recognized or potential heritage status is summarized in Table 3. The locations of each CHR appear on Map 8.

6.2 Study Area

The study area consists of an irregular shaped parcel of land with an area of 3.99 ha in size (Map 1–Map 2). The corridor-like study area runs from the east bank of the South Nation River at the Principale Street bridge, runs northward up Brisson St, turns leads easterly through agricultural lands to Laurier Street and further east into the lagoon area in the Town of Casselman, Ontario, consisting of parkland, farm fields, roadways and municipal infrastructure (Image 3–Image 16). The study area runs through roadways, pathways and some right-of-ways adjacent to various properties along the corridor including fallow agricultural fields, natural areas, a park and Conservation Area.

The southwest extent of the study area is accessed by Brisson Street which intersects with Regional Road 3/Rue Principale Street at the north end of the Town of Casselman (Image 3). An adjacent private road to an existing farm (Nation View Farm, see Image 15–Image 16) branches off from where Brisson Street intersects with Rue Principale Street, although this private road is outside of the study area. The properties adjacent to this portion of the study area consist of multi-residential structures, a retirement residence, agricultural farms and fields, and open parkland with access to the South Nation River (see Image 1–Image 16). The Rue Principale Street Bridge,

also known as the Paul Émile Lévesque Bridge, is located directly to the south of the study area and consists of a two-lane bridge that spans the South Nation River. The bridge provides an expansive view of part of the study area, including the historic J.N. Coupal Dam and powerhouse.

In addition, the southwest portion of the study area contains part of the Doran Park/High Falls Conservation Area (see Image 5) and provides access to a small gravel parking area which leads to Doran Park/High Falls Conservation Area. Several private driveways are located off Brisson Street, and the road itself dead ends near the power generating station and is blocked by a chain link fence (Image 6). The existing SPS 1 (sewage pumping station) is housed in a brick and stucco building located at the park entrance, it resembles a train station (Image 4). Doran Park/High Falls Conservation Area itself consists of open manicured lawn with some mature trees and a gazebo. High Falls Conservation Area also encompasses the west side of the South Nation River.

A private property with several frame buildings located at 18 Brisson Street is accessed by private driveways off Brisson Street. The property contains at least one main residence and several outbuildings. The main residence appears to be a one-and-a-half storey frame structure with a gable roof. The field survey observations, historical research and consultation, determined this property has no potential cultural heritage value or interest.

7.0 HERITAGE ASSESSMENT

The study area and all adjacent properties were assessed for potential CHVI to determine if there were any CHRs. As a result of consultation, existing recognition, research, and the field survey, the potential CHRs heritage status are summarized in Table 3. The location of the CHRs (including both BHRs and CHLs) in relation to the study area is displayed on Map 8.

Table 3: CHRs with Known or Potential CHVI

CHR#	Type of Property	Address	Heritage Recog.	Location	Description of Known or Potential CHVI	Image
CHR-1	Bridge (BHR)	Rue Principale Street/ Paul Émile Lévesque Bridge	None	Adjacent to study area	Built in 1976-1977, the bridge has a municipal plaque installed on the east side of the bridge. The bridge provides views of the South Nation River and a 1905 railroad bridge that crosses the river. Historic mapping indicates that a bridge was extant in this location by 1908, and a 1954 aerial image corresponds with the layout of roads in 1908 and 1936. However, it appears that at some point between 1954 and the current period, Principale Street was slightly realigned to mitigate a curve in the roadway that is no longer present on current aerial imagery. Preliminary analysis indicates that the property is physically and functionally linked to its surroundings based on its use as an active bridge for Principale Street and joins the west and east banks of the South Nation River, and as a historic location of the water crossing.	
CHR-2	Hydro Generating Station (BHR)	J.N. Coupal Dam and Casselman Hydroelectric Generating Station	None	Adjacent to study area	In 1908, a local businessman named J.N. Coupal began construction on a 140 metre (460 foot) hydroelectric dam and across the South Nation River with an associated 125-watt powerhouse in order to provide electricity for his home, flour mill, and some surrounding neighbours. The project was completed in 1910 and the local village council granted a 30-year franchise to Coupal in order to supply electricity to the rest of the Village of Casselman (Hydro Ottawa 2023). By 1922, the flow of electricity to the village had increased due to Coupal closing his gristmill although demand had risen to the extent that some local villagers were on waiting lists to receive the service. A local power commission was formed in 1924 and a new ten-year contract with Coupal was negotiated for the continuation of electrical services. All excess profits were refunded to customers, and at the end of the ten-year contract period, another 30-year franchise was negotiated based on the terms initially established in 1910 (Hydro Ottawa 2023). By 1952 the demand for electricity had increased beyond the capacity of Coupal's original system, so the village established a publicly managed utility company called Casselman Hydro. Casselman Hydro remained its own entity managed by Dr. Guy Laplante until 2022, when it was acquired by Hydro Ottawa during an amalgamation of other small utility companies, such as Kanata Hydro and Nepean Hydro, along with Casselman Hydro (Hydro Ottawa 2023). A new hydroelectric dam was constructed at an unknown date across the South Nation River, but the ruins of Coupal's original dam still remain, and the powerhouse is still in operation as part of Hydro Ottawa's larger operations. Historic mapping shows Coupal's dam and powerhouse are present in a 1936 topographic map and is also apparent on a 1954 aerial. Modern aerial imagery shows the ruins of Coupal's original dam, Coupal's powerhouse, and the more recent Hydro Ottawa hydroelectric dam. No dam appears in the historic mapping before 1936.	 North Side of Dam From the Powerhouse  J.N. Coupal's Historic Dam, Facing East

CHR#	Type of Property	Address	Heritage Recog.	Location	Description of Known or Potential CHVI	Image
					Preliminary analysis indicates that the following potential CHVI: J.N. Coupal's original hydroelectric dam and powerhouse are early examples of a 20th century hydroelectric generating station. The Coupal dam and powerhouse have direct associations with local businessman J.N. Coupal, who built the generating station in order to supply power to his home, gristmill, and surrounding residences in the Village of Casselman. The Casselman Hydroelectric Generating Station demonstrates the work and ideas of local businessman J.N. Coupal, who built the original 1908 dam to supply electric power to his gristmill and residence, and later to the Village of Casselman. The Casselman Hydroelectric Generating Station is physically, functionally, visually, and historically linked to its surroundings. The original dam has been in the same location for over a century and is physically linked to the South Nation River by its function as a hydroelectric power station.	
CHR-3	Landscape (CHL)	South Nation River Corridor	None	Adjacent to study area	The South Nation Conservation Authority (SNCA) describes the South Nation River as *175 km long and drains an almost flat plain, dropping only 85 metres from the headwaters north of Brockville and empties into the Ottawa River, near Plantagenet. It has a watershed that covers 3,900 square kilometres* (SNCA 2020). The area surrounding the river, now predominately used for agriculture, used to covered in white pine, and can be prone to flooding. The river is named the "South Nation River" to distinguish it from a similarly-named river in Quebec, both of which are acquired for the French name for the Weskarini Algonquin First Nation (Natural Resources Canada 2020). It is a tributary of the Ottawa River, which has been designated as a Canadian Heritage River in 2016. Preliminary analysis indicates that the following potential CHVI: The South Nation River has direct associations with not only First Nations communities in the area, but also with Euro-Canadian settlement along its banks. The South Nation River has potential to yield information that contributes to our understanding of Indigenous history in the area through archaeological potential, however, this is addressed in a separate process. The South Nation River is important in defining, maintaining and supporting the character of the surrounding landscape. The river corridor has influenced settlement and the surrounding development. The South Nation River is physically, functionally, visually, and historically linked to its surroundings. It was a principal factor that influenced Pre-Contact lifeways	

CHR#	Type of Property	Address	Heritage Recog.	Location	Description of Known or Potential CHVI	Image
					and historic settlement patterns, in addition to encouraging European settlement.	
CHR-4	Park (CHL)	Doran Park/High Falls Conservation Area	None	Within study area	Doran Park, located on the east bank of the South Nation River as part of the High Falls Conservation Area which is managed by the South Nation Conservation Authority (SNCA). High Falls Conservation Area spans both banks of the South Nation River and consists of 5.5 acres of manicured parkland, BBQ and picnic facilities, a playground, floating dock, and boat launch. The area is well known for pickerel and pike fishing and is the site of several angling derbies (Conservation Ontario 2023). The ruins of J.N. Coupal's original hydroelectric dam are contained within the boundaries of the park, and SNCA notes that the area is known for its historic views (SNCA 2020b). The area was originally known as the Casselman Conservation Reservoir and was purchased by the SNCA in 1984. Prior to that, a fishing weir was constructed across the South Nation River in 1966 (SNCA 2020b). More research is required to determine the history of the Casselman Conservation Reservoir and its potential importance to the community. Preliminary analysis indicates that the following potential CHVI: Doran Park/High Falls Conservation Area is important in defining, maintaining, or supporting the character of an area. The park has been a Conservation Area since 1984, and before that was part of the Casselman Conservation Reservoir. Aerial photos from 1954 indicate that that area appears roughly the same as today, illustrating the area's longstanding use as parkland and/or open space. Doran Park/High Falls Conservation Area is physically, functionally, and visually linked to its surroundings which includes the South Nation River. It physically serves as a park space with river access for both watercraft and anglers, it is functionally linked for similar reasons, and it is visually linked due to its close proximity to the Principale Street Bridge and the "historic views" of the J.N. Coupal Dam as noted by the SNCA.	
CHR-5	Cemetery (CHL)	J. Brisson Farm Cemetery	None	Adjacent to study area	This unmarked cemetery is located adjacent to the study area between Brisson Street and Doran Park and a private farm road. The cemetery was part of Casselman United Church (formerly the Presbyterian Church) sold the church property to David Valley, the sale excluded the cemetery lands which remain under the ownership of the Trustees of the Congregation of South Casselman Village. A transcription of the 10 visible grave markers was undertaken in 1995 by the Ottawa Branch of the Ontario Genealogical Society, which were associated with the burials of 17 people. The cemetery is currently inactive, and it remains unclear whether there are any unmarked burials within or beyond the current parcel Preliminary analysis indicates that the following potential CHVI: Physical, visual, and historical link to the Village of Casselman as a now inactive former church cemetery.	

8.0 PROPOSED DEVELOPMENT

J.L. Richards & Associates, Ltd. states that upgrades are needed for the Main Sewage Pumping Station (SPS) located within the Municipality of Casselman, United Counties of Prescot and Russell. The assessment was carried out in support of the Cultural Heritage Screening Process for Municipal Class Environmental Assessments in accordance with the *Environmental Assessment Act.* The results of this assessment will be used to assist with detailed design for the installation "of upgrades to the main sewage pumping station to accommodate long-term projected design flows. The upgrades consist of the installation of a new force main alignment beside the existing force main, modification to existing pumping infrastructure and equipment, and the installation of an emergency gravity bypass overflow to discharge to the South Nation River. The force main alignment consists of a section within the roadway allowance of Brisson Street, the right-of-way easement between Brisson and Laurier Street, roadway allowance of Laurier Street, roadway allowance of the Lagoon access road and Lagoon property" (JL Richards Pers. Comm 2025a). The proposed development has completed the detailed design phase (see Figure 1).

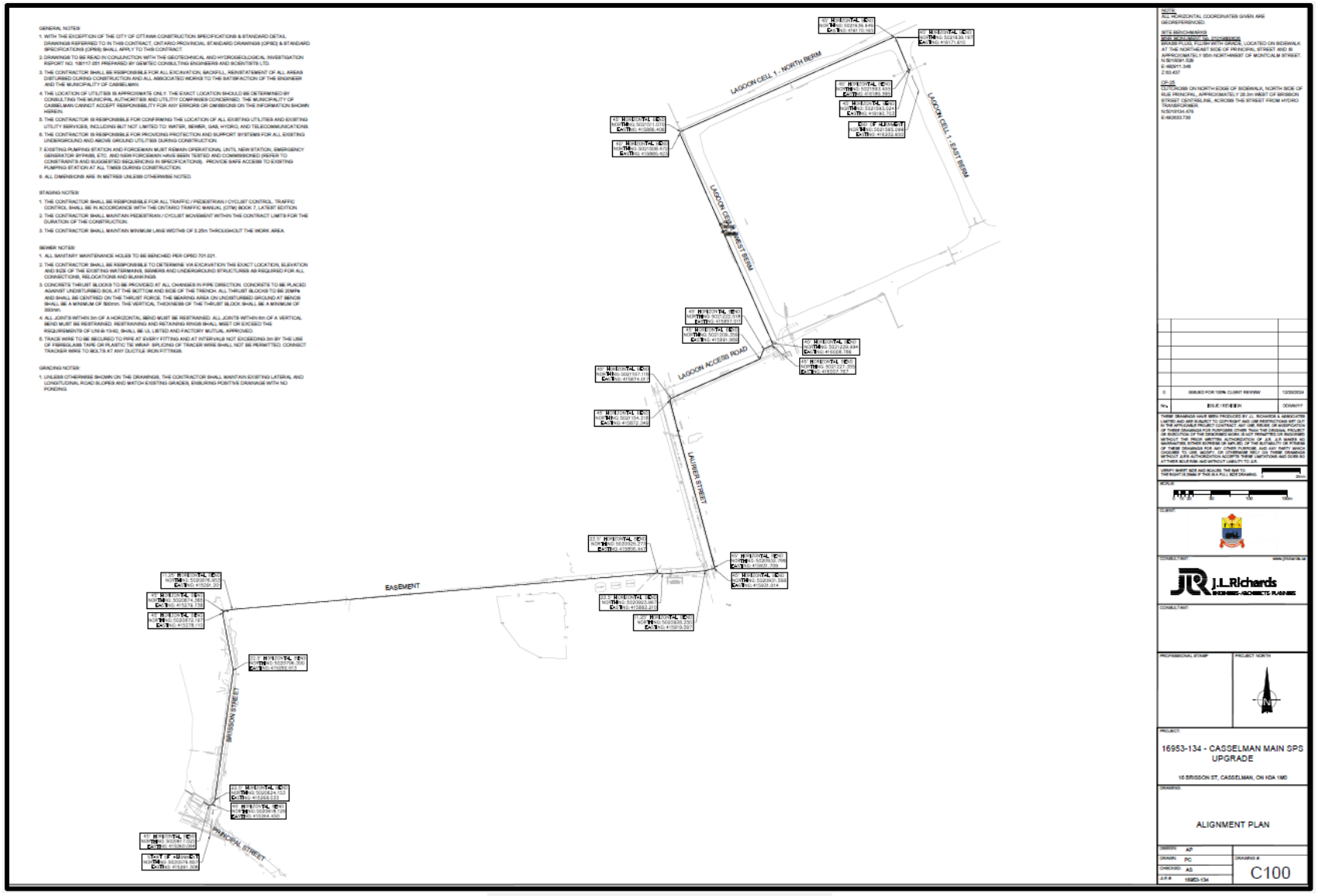


Figure 1: Proposed Project Plan
(JL Richards 2025b)

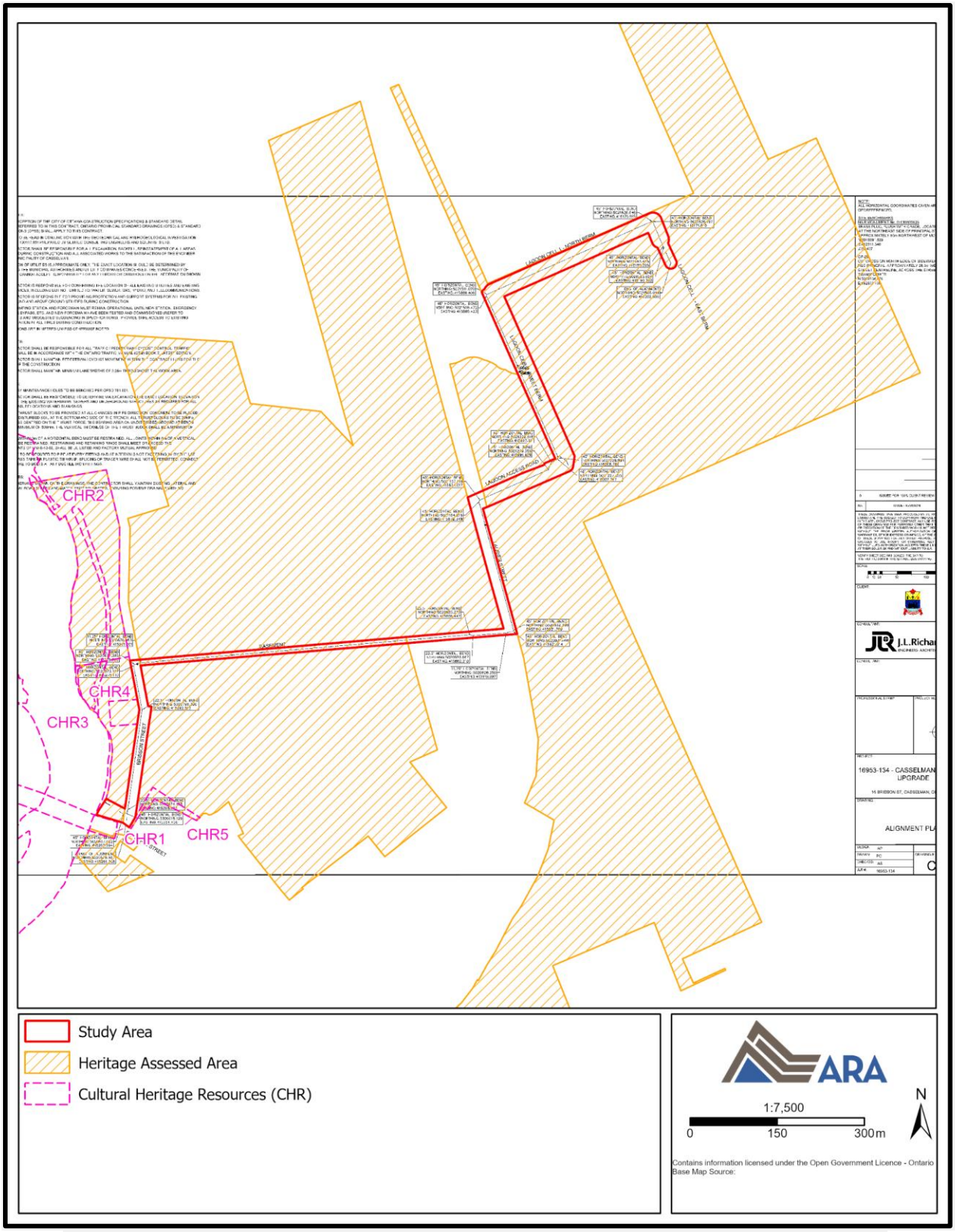


Figure 2: Proposed Project Plan with Potential Heritage Resources (BHRs and CHLs)
(based on JL Richards 2025b)

9.0 ALTERNATIVES CONSIDERED

The following is a progression of the project plan from preliminary phase and into the 66% design. The preferred option is presented and described above in Section 8.0

9.1 Preliminary Planning Phase

The upgrades are needed for the Main Sewage Pumping Station (SPS) located within the Municipality of Casselman, United Counties of Prescot and Russell. The preliminary plans were described as requiring work as follows: “a third pump to meet projected design flows. In order to accommodate upgraded design flows, a new force main will be designed and installed along the alignment of the existing force main within the roadway allowance and existing easement, and the mechanical screen will need to be replaced. Lastly, an emergency gravity bypass overflow sewer will be designed and installed to discharge to the South Nation River” (JLR 2023 and 2024). (see Figure 4).

9.2 66% Design

In the fall of 2024, the design phase was underway and the project alignment shifted slightly within the lagoon property parcel on the northeast end of the study area. The alignment still enters the lagoon property along the “Lagoon Access Road”, but now heads northward before the lagoons and then eastward along the north side of the property and then southward along the “Lagoon Cell 1 – East Berm.

The project location remained within the heritage assessed area and does not require further assessment. The location and scale of the proposed development did not change, the direct and indirect impacts remain the same based on the 66% design plan. The overall location/proposed design was not modified and the impacts were not revised.

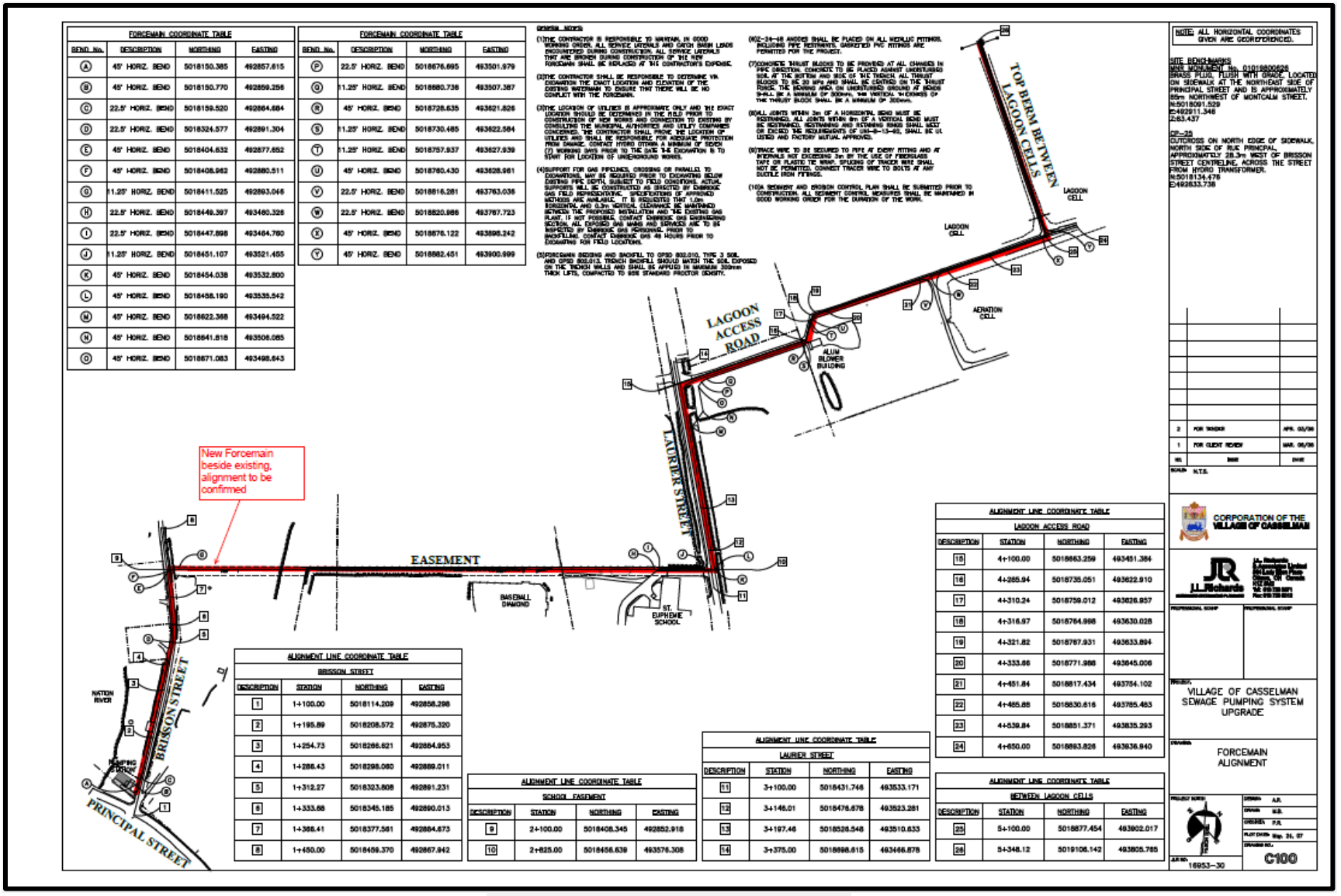


Figure 3: Preliminary Project Plan
(JL Richards 2023)

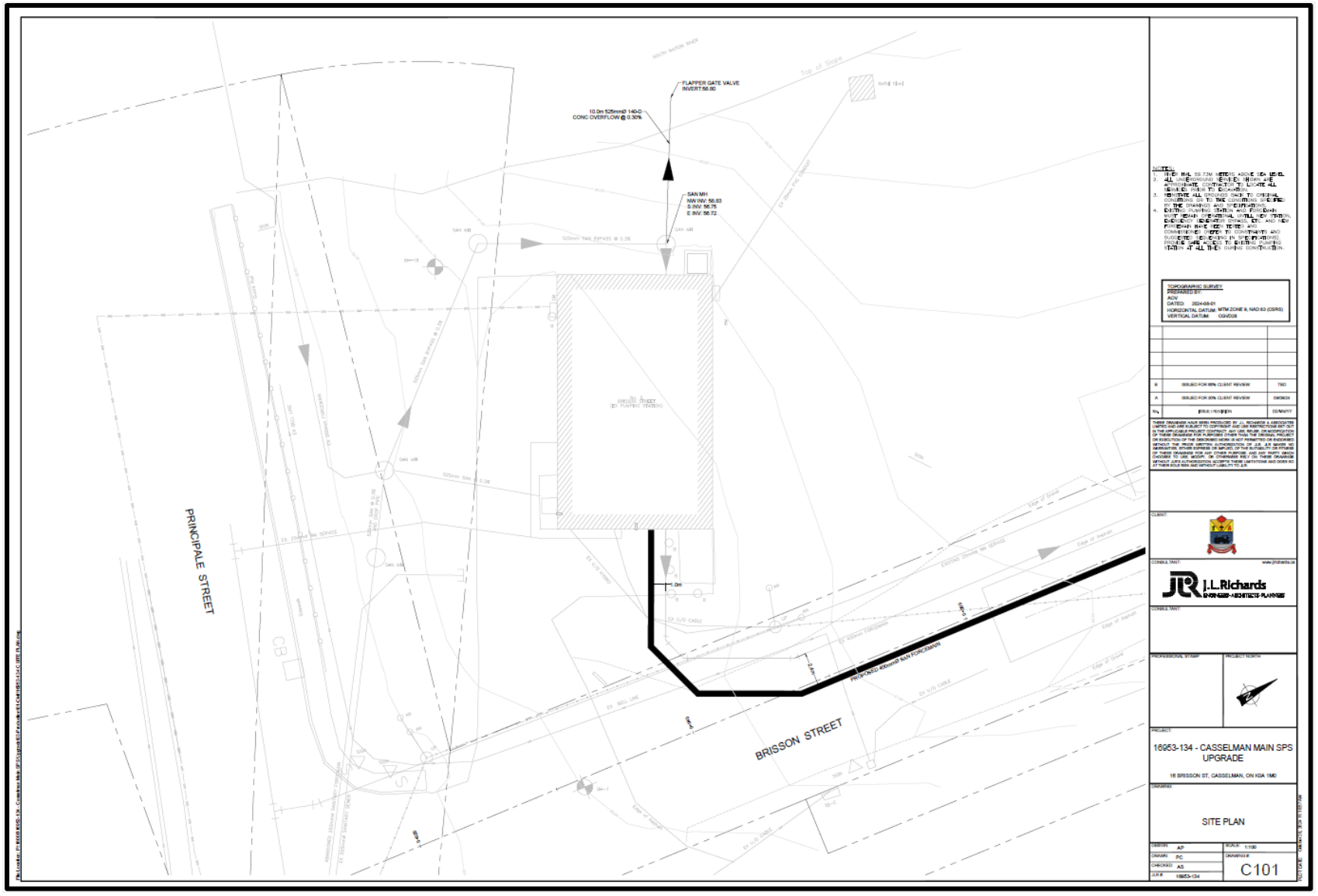


Figure 4: 66% Detail Design
(JL Richards 2024)

10.0 ANALYSIS OF POTENTIAL IMPACTS

The MCM *InfoSheet #5: Heritage Impact Assessments and Conservation Plans* (MCM 2006b) provides a list of potential negative impacts to consider when evaluating any proposed development or site alteration.

Direct impacts (those that physically affect the heritage resources themselves) include, but are not limited to initial project staging, excavation/levelling operations, construction of bridges and access roads. These direct impacts may destroy some or all significant heritage attributes or may alter soils and drainage patterns and adversely impact unknown archaeological resources.

Indirect impacts include but are not limited to alterations that are not compatible with the historic fabric and appearance of the area, the creation of shadows that alter the appearance of an identified heritage attribute, the isolation of a heritage attribute from its surrounding environment, the obstruction of significant views and vistas, change in land use such as rezoning allowing for a reduction in open spaces and other less-tangible impacts. There may be positive environmental and cultural effects.

Project impacts and mitigation measures may need refinement as a project design develops depending on the scope considered for implementation. As such, potential impacts and mitigation options related to the project will be discussed at a high level as they relate to the development plan outlined in Section 8.0. Currently, within the study area, a new force main will be designed and installed along the alignment of the existing force main within the roadway allowance and existing easement. As such, visual impacts from this project will be during construction phase as the infrastructure is to be installed underground.

No CHRs were identified within the study area. Five CHRs were identified adjacent to the study area (see Map 8). and mitigation options related to the project will be discussed at a high level as they relate to the development plan outlined in Section 8.0 (see Table 4).

Table 4: Impacts and Mitigation Measures

Ref #	Location	Heritage Recognition	Type and Description of Potential/Anticipated Impacts	Mitigation Measures: i. Mitigation Option ii. Mitigation Recommendation
CHR1	Rue Principale Street/ Paul Émile Lévesque Bridge	none	There are no anticipated direct impacts to the built heritage resource or heritage attributes as a result of the proposed project. There is the potential for accidental damage to the heritage resource and/or heritage attributes during the construction/development process. Potential impacts may occur during the initial project staging, excavation or roadway/levelling operations, and during the construction phase.	**Recommendations to minimize indirect impacts:** Any proposed construction staging areas should avoid the use of land associated with the bridge. Avoid leaning equipment or materials against the bridge. During construction, it is recommended that marked maps be provided to the construction crew outlining the bridge should be avoided throughout the duration of the construction period.
CHR2	J.N. Coupal Dam and Casselman Hydroelectric Generating Station	none	There are no anticipated direct impacts to the built heritage resource or heritage attributes as a result of the proposed project. This the facilities linked with the potential CHVI of the J.N. Coupal Dam and Casselman Hydroelectric Generating Station are located well away from the study area. No indirect impacts are anticipated.	**none**
CHR3	South Nation River Corridor	none	The proposed study area is near the South Nation River with the potential for bypass pipe replacement. This pipe runs out of the east bank and into the river by the Levesque bridge. As a result of the potential pipe replacement, the South Nation Riverbank and vegetation may be impacted as a result of the proposed project.	**Recommendations to minimize indirect and direct impacts:** That facility improvements and any construction staging areas should avoid the use of land on or near the bank of CHR3 South Nation River Corridor. That if damage to existing vegetation along the riverbank is unavoidable, replacement in kind should be considered during detail design. That during detailed design, consideration should be given to the use of vegetation and trees as a screening tool, depending on how intrusive any new piping/infrastructure are to be in the landscape. During construction, it is recommended that construction fencing be installed. The fencing should be maintained throughout the duration of the construction period.
CHR4	Doran Park/High Falls Conservation Area	none	There are no anticipated direct impacts to the built heritage resource or heritage attributes as a result of the proposed project. There is the potential for accidental damage to the heritage resource and/or heritage attributes during the construction/development process. Potential impacts may occur during the initial project staging, excavation or installation operations, and during the construction phase.	**Recommendations to minimize indirect impacts:** Any proposed construction staging areas should avoid the use of land associated the Conservation Area. That if damage to existing vegetation along roadway is unavoidable, replacement in kind should be considered during detail design. During construction, it is recommended that construction fencing be installed along the lot line. The fencing should be maintained throughout the duration of the construction period.

Ref #	Location	Heritage Recognition	Type and Description of Potential/Anticipated Impacts	Mitigation Measures: i. Mitigation Option ii. Mitigation Recommendation
CHR5	J. Brisson Farm Cemetery	*none*	There are no anticipated direct impacts to the built heritage resource or heritage attributes as a result of the proposed project. There is the potential for accidental damage to the heritage resource and/or heritage attributes during the construction/development process. Potential impacts may occur during the initial project staging, excavation or roadway/levelling operations, and during the re-construction phase.	**Recommendations to minimize indirect impacts:** That facility improvements and any construction staging areas should avoid the use of land on or near the bank of CHR5 J. Brisson Farm Cemetery. That if damage to existing vegetation along roadway is unavoidable, replacement in kind should be considered during detail design. A cemetery investigation must be carried out in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO (ARA 2024). During construction, it is recommended that construction fencing be installed along the lot line, with a buffer as outlined in the Archaeology recommendations. The fencing should be maintained throughout the duration of the construction period.

11.0 RECOMMENDATIONS AND CONCLUSIONS

The study area consists of an irregular shaped parcel of land with an area of 3.99 ha in size. The corridor-like study area runs from the east bank of the South Nation River at the Principale Street bridge, runs northward up Brisson St, turns leads easterly through agricultural lands to Laurier Street and further east into the lagoon area in the Town of Casselman, Ontario.

This report was initially drafted at preliminary planning phase in October 2024, the project has since progressed to 99%. While the trajectory of the corridor was adjusted in the northeast area with the lagoons, the project location remained within the October 2024 heritage assessed area and did not require further assessment. It is now noted that the location and scale of the proposed development did not change, the direct and indirect impacts remain the same based on the new development plan. The location/proposed design was not modified and the impacts were not revised, this report was revised to reflect the 99% phase of the proposed plans. No addendum to this report was needed.

A field survey of the study area was conducted, and all potential CHRs noted were evaluated. In total, five CHRs were identified adjacent to the study area as having CHVI or potential CHVI. No CHRs were identified within the study area.

The impact analysis showed that only CHR3 South Nation River Corridor may be directly impacted by the proposed project. Most CHRs have the potential for indirect impacts as a result of accidental damage to the individual heritage resource and/or heritage attribute during the construction/development process. Potential impacts may occur during the initial project staging, excavation or installation operations, and during the road re-construction phase.

The following strategies are recommended to address the identified potential adverse impacts and to be considered during subsequent design phases to ensure the conservation of cultural heritage resources within and adjacent to the study area:

- Any proposed construction staging areas should avoid the use of land associated CHR1-5.
- During construction, it is recommended that construction fencing be installed to protect CHR3-5. The fencing should place along the lot line and be maintained throughout the duration of the construction period.
- At the time that this report was written, proposed plans were preliminary. If in the future at detail design, the location or scale of the proposed development were to change, the direct and indirect impacts might be altered based on the new development plan. If the location or proposed design is modified, the impacts should be revised in addendum to this report
- CHR5 J. Brisson Farm Cemetery, in particular, should be avoided by construction staging, trench digging, infrastructure installation, road reconstruction and any type of ground disturbance . As per the Stage 1 Archaeological Assessment, a cemetery investigation must also be carried out in the vicinity of the Cemetery on J. Brisson's Farm (CM-03449) to determine whether any burial features extend into the study area. This Stage 3 assessment must be conducted in accordance with Section 3.3.3 and Section 4.2.3 of the 2011 *S&Gs*, and a Cemetery Investigation Authorization must be obtained from the BAO.
- The proposed development has the potential to impact the natural landscape (i.e., the loss of trees or vegetation or crops changes to both the natural and agricultural characters of the study area).

- Public consultation may result in additional potential cultural heritage resources being identified. These potential cultural heritage resources should be reviewed by a qualified heritage consultant to: 1) determine their CHVI, 2) evaluate potential project impacts, and 3) suggest strategies for future conservation of any candidate cultural heritage resources.
- That previously-unrecognized Cultural Heritage Landscapes or Built Heritage Resources that possess potential cultural heritage value or interest discussed in this report *may* be worthy of inclusion on the municipality's *Register of Properties of Cultural Heritage Value or Interest*.
- This report should be provided to staff/planners at the municipal and regional level.
- That a Stage 1 and Stage 2 archaeological assessment has been completed, concluding with a recommendation that all areas of archaeological potential that could be impacted by the project be subject to a Stage 2 property assessment in accordance with Section 2.1 of the 2011 *S&Gs*. No soil disturbing activities should take place until all archaeological concerns are mitigated and all reports are accepted by MCM.
- That should the facility improvement activities or the project location expand beyond the scope examined in this report, a qualified heritage consultant should be retained to determine the potential impacts and suggest mitigation measures.

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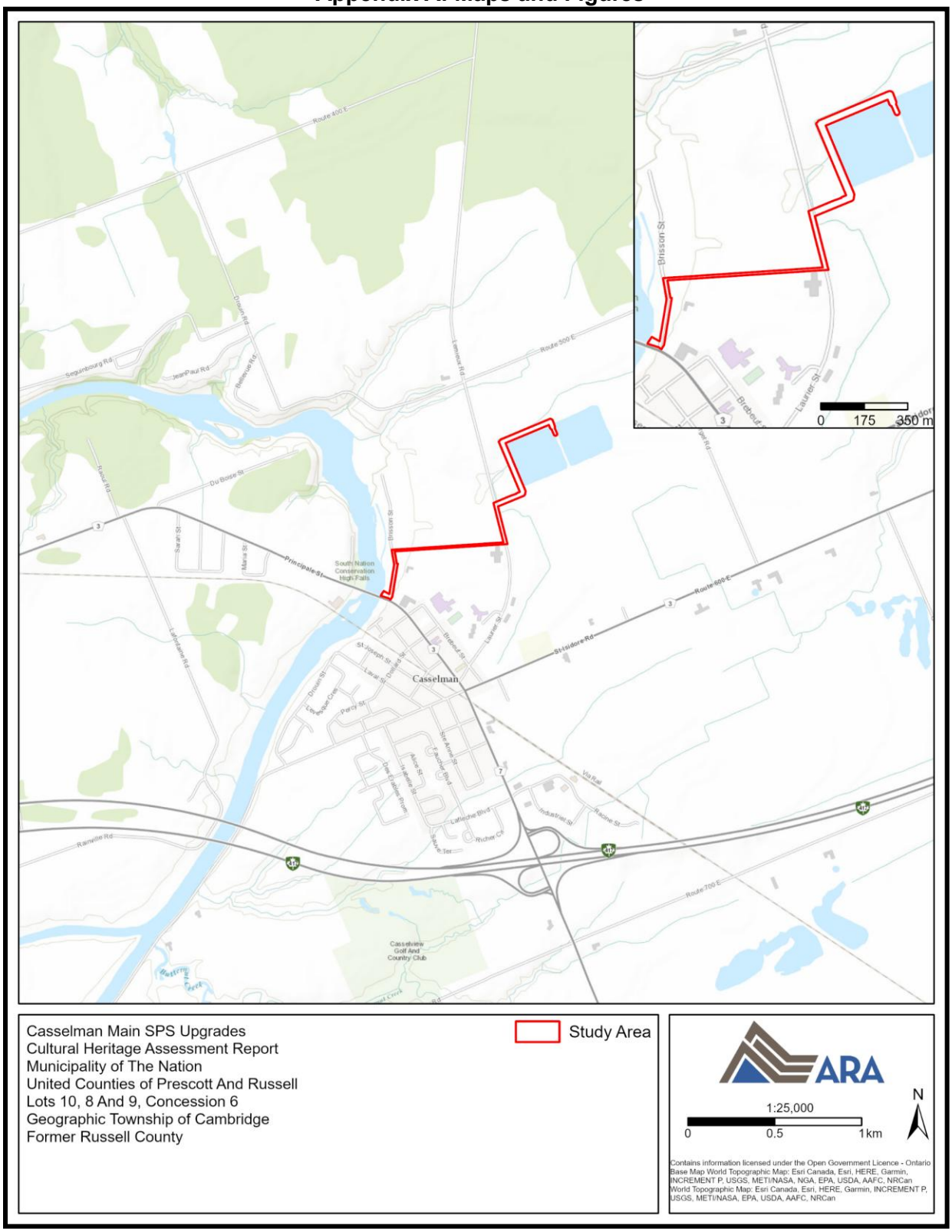
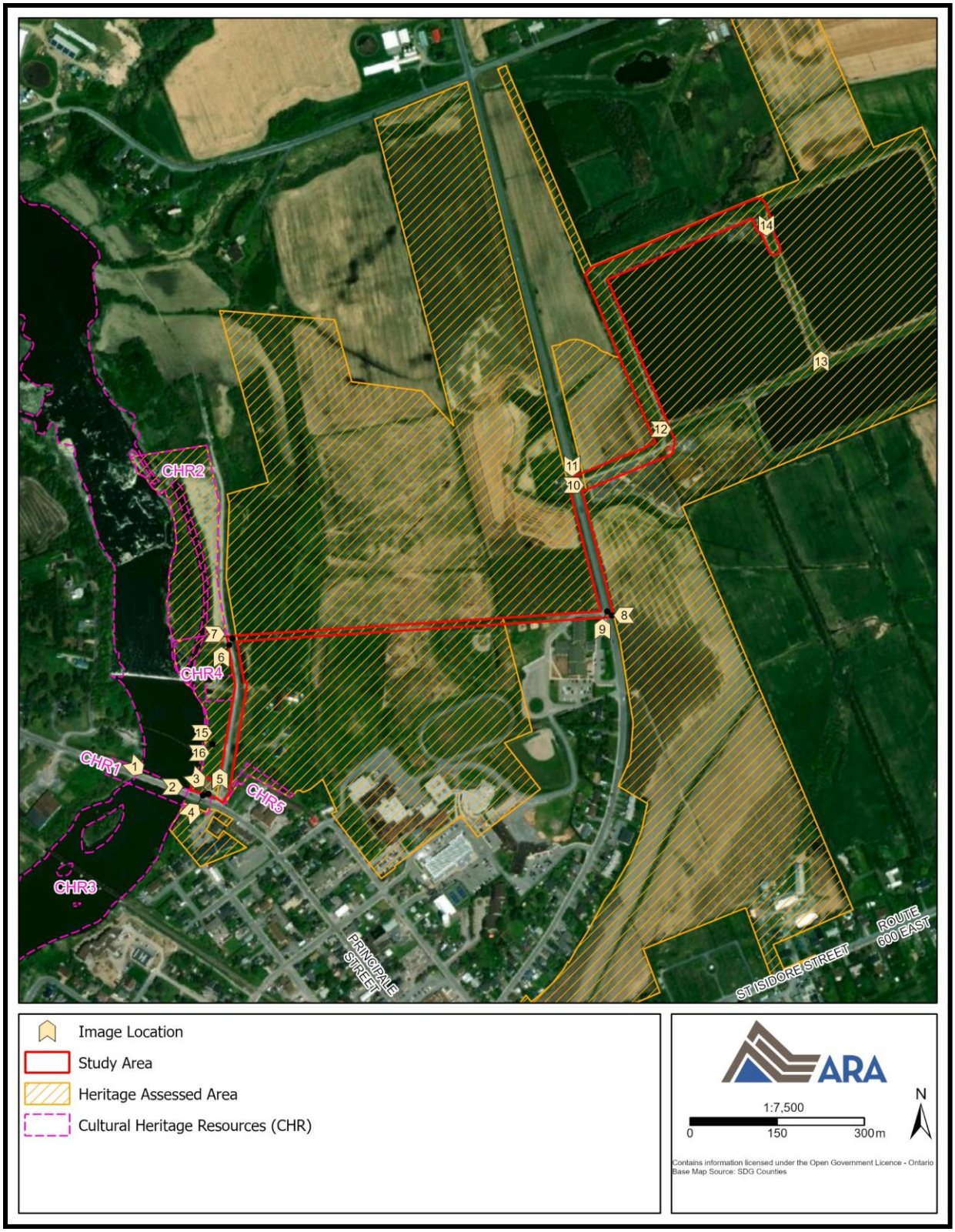
Appendix A: Maps and Figures



Map 7: Study Area in the Municipality of Casselman
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri)



Map 8: Assessment Results Map
(Produced under licence using ArcGIS® software by Esri, © Esri; United County of Prescott and Russell 2020)

Image 1: Study Area on East Bank of South Nation River
(May 27, 2023; View Facing Southeast)

Image 2: Current Backflow Pipe at West End of Study Area
(July 11, 2024; View Facing Northeast)

Image 3: Intersection of Rue Principale Street and Brisson Street
(May 27, 2023; View Facing Southeast)

Image 4: View of West Extent of Study Area Looking North Brisson Street
(July 11, 2024; View Facing Northeast)

Image 5: View of West Extent of Study Area Looking North
(June 15, 2024; View Facing Northeast)

Image 6: Study Area along Brisson Street
(July 11, 2024; View Facing North)

Image 7: Study Area Running Eastward from Brisson Street
(July 11, 2024; View Facing East)

Image 8: Study Area From Laurier looking Across Field from Laurier Street
(Google Streetview; View Facing West)

Image 9: Study Area Running Northward along Laurier Street
(Google streetview; View Facing North)

Image 10: Study Area – West Extent at Lagoon Property
(July 11, 2024; View Facing East)

Image 11: Study Area – West Extent at Lagoon Property
(Google streetview; View Facing East)

Image 12: Study Area – Looking East Toward Lagoons
(June 15, 2024; View Facing East)

Image 13: Study Area – West Extent at Lagoon Property
(June 15, 2024; View Facing North)

Image 14: Study Area – West Extent at Lagoon Property
(June 15, 2024; View Facing South)

Image 15: Nation View Farmhouse Adjacent to Study Area
(July 11, 2024; View Facing East)

Image 16: Nation View Farmstead Adjacent to Study Area
(July 11, 2024; View Facing Northeast)

Appendix No. 4

DFO Review Letter

Fisheries and Oceans Canada
Pêches et Océans Canada

Ontario and Prairie Region
Fish and Fish Habitat Protection Program
867 Lakeshore Rd.
Burlington, ON
L7S 1A1

Région de l'Ontario et des Prairies
Programme de protection du poisson et de son habitat
867 chemin Lakeshore
Burlington, ON
L7S 1A1

January 13, 2025

Our file *Notre référence*
24-HCAA-02897

Mark St Pierre
J. L. Richards & Associates Limited
1000-343 Preston Street
Ottawa, ON, K1N 1N4

Subject: Sewage Station Upgrades, South Nation River, Casselman (24-HCAA-02897) – Implementation of Measures to Avoid and Mitigate the Potential for Prohibited Effects to Fish and Fish Habitat

Dear Mark St Pierre:

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on December 3, 2024. We understand that you propose to:

- Install a new emergency overflow pipe at South Nation River for a footprint below the high water mark of approximately 12.1m^2; and,
- Work in isolation of flow or open water to avoid sedimentation of the watercourse.

Our review considered the following information:

- Request for Review form and associated documents submitted on December 3, 2024.

Your proposal has been reviewed to determine whether it is likely to result in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*; and,
- effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*.

The aforementioned impacts are prohibited unless authorized under their respective legislation and regulations.

To avoid and mitigate the potential for prohibited effects to fish and fish habitat (as listed above), we recommend implementing the measures listed below:

- Plan in-water works, undertakings and activities to respect timing windows to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed and migrate
- Capture, relocate and monitor for fish trapped within isolated, enclosed, or dewatered areas
    - Dewater gradually to reduce the potential for stranding fish
- Screen intake pipes to prevent entrainment or impingement of fish
    - Use the code of practice for water intake screens
- Apply the interim code of practice for temporary cofferdams and diversion channels
- Limit impacts on riparian vegetation to those approved for the work, undertaking or activity
    - Limit access to banks or areas adjacent to waterbodies
    - Construct access points and approaches perpendicular to the watercourse or waterbody
    - Re-vegetate the disturbed area with native species suitable for the site
- Replace/restore any other disturbed habitat features and remediate any areas impacted by the work, undertaking or activity
- Restore stream geomorphology (i.e., restore the bed and banks, gradient and contour of the waterbody) to its initial state
- Conduct in-water undertakings and activities during periods of low flow
- Develop and implement an Sediment Control Plan to minimize sedimentation of the waterbody during all phases of the work, undertaking or activity
    - Conduct all in-water works, undertakings or activities in isolation of open or flowing water to reduce the introduction of sediment into the watercourse
    - Schedule work to avoid wet, windy and rainy periods (and heed weather advisories)
    - Monitor the watercourse to observe signs of sedimentation during all phases of the work, undertaking or activity and take corrective action
- Do not deposit any deleterious substances in the water course
- Develop and implement a response plan to avoid a spill of deleterious substances
- Aquatic invasive species are introduced and spread through transporting water, sands and sediments and using contaminated construction equipment. To prevent the spread of aquatic invasive species during construction in aquatic environments:
    - Ensure all equipment arrives on site clean and free of invasive species;
    - Clean, drain and dry any equipment used in the water; and,
    - Never move organisms or water from one body of water to another.

Provided that you incorporate these measures into your plans, the Program is of the view that your proposal is not likely to result in the contravention of the above mentioned prohibitions and requirements.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (Projects near water (dfo-mpo.gc.ca)) or consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to remain in compliance with the *Fisheries Act*, and the *Species at Risk Act*.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to DFO.OPHabitat.MPO@dfo-mpo.gc.ca or 1-855-852-8320.

Please notify this office at least 10 days before starting any in-water works. Send your notification to the assessor (contact information below) and the DFO 10 notification mailbox: DFO.OP.10DayNotification-Notification10Jours.OP.MPO@dfo-mpo.gc.ca. We recommend that a copy of this letter be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your proposal.

If you have any questions with the content of this letter, please contact Samantha Arevalo at Samantha.arevalo@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Samantha Arevalo
Biologist – Triage
Fish and Fish Habitat Protection Program
Ontario and Prairie Region
Fisheries and Oceans Canada

Appendix No. 5

Species at Risk Screening Assessment

GEMTEC
www.gemtec.ca

Species at Risk Screening Assessment
Casselman Main Sewage Pumping Station Upgrades
Various Streets
Casselman, Province

GEMTEC Project: 100117.051

GEMTEC
www.gemtec.ca

Submitted to:

J.L. Richards & Associates Limited
1000-343 Preston Street
Ottawa, Ontario
K1S 1N4

Species at Risk Screening Assessment
Casselman Main Sewage Pumping Station Upgrades
Various Streets
Casselman, Province

December 18, 2024
GEMTEC Project: 100117.051

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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by J.L. Richards & Associates Limited (JLR) to undertake a Species at Risk (SAR) Screening Assessment in support of the proposed Casselman Main Sewage Pumping Station (SPS) upgrades along various streets in Casselman, Ontario.

It is understood that the proposed SPS upgrades will occur along an approximately 1930 m stretch of land, crossing Brisson Street, the easement between Brisson Street and Laurier Street, Laurier Street, the Lagoon Access Road, and along the western-northern borders of the Lagoon Cells.

In accordance with the requirements of a Municipal Class Environmental Assessment (Class A+), the Village of Casselman has identified the need to complete a SAR Screening Assessment for the proposed project area.

1.1 Project Description

The general project area is illustrated on Figure A.1 in Appendix A. A detailed site layout is provided on Figure A.2 in Appendix A. Based on information provided to GEMTEC by JLR via a Request for Proposal document, the project will consist of the following:

- Installation of a new force main beside the existing force main. The final alignment is provided on Figure A.2 (within road allowances and existing easements); and
- Installation of a new influent sewer within the property limits of the SPS, with a new maintenance chamber. The invert is expected to be approximately 6 to 7 metres below surface. It is understood that the details of this installation are to be confirmed.

1.2 Objective and Scope of Work

The objective of the SAR Screening Assessment presented herein is twofold: 1) to identify the presence or potential presence of any SAR and their regulated habitat within the project area, 2) to recommend established and effective avoidance and mitigation measures to ensure that the project is completed in accordance with the provincial *Endangered Species Act, 2007*, the federal *Species at Risk Act*, and the *Conservation Authorities Act.*

To meet the objectives outlined above, the following scope of work was completed:

- Task 1 – Desktop Assessment
- Task 2 – Site Investigation
- Task 3 – Assessment and Reporting

2.0 METHODOLOGY

2.1 Desktop Review

A desktop review was completed to aid in the scoping of field investigations and to gather information relating to natural heritage features that may be present within the proposed project area or within 1 km of the subject property. An additional component of the desktop review was to assess the potential presence of SAR to occur on the subject site or within the study boundary based on a review of publicly accessible occurrence records and review of SAR habitat requirements and range maps.

Information regarding the potential presence of natural heritage features and SAR within the vicinity of the site was obtained from the following sources:

- Make a Map: Natural Heritage Areas (OMNRF, 2023);
- Land Information Ontario (OMNRF, 2011);
- Ontario Geological Survey (OGS, 2019);
- Department of Fisheries and Oceans Canada Aquatic SAR Maps (DFO, 2023);
- Fish ON-Line (ONMRF, 2023);
- Breeding Bird Atlas of Ontario (Cadman, et al., 2007);
- eBird Canada Hotspots (eBird Canada, 2023);
- Atlas of Mammals of Ontario (Dobbyn, 1994);
- iNaturalist Explore Observations Map (iNaturalist, 2023);
- Ontario Reptile and Amphibian Atlas (Ontario Nature, 2020);
- Village of Casselman Official Plan (Casselman, 2008);
- United Counties of Prescott-Russell Official Plan (UCPR, 2022); and
- United Counties of Prescott-Russell À La Carte On-line Mapping (UCPR, undated).

2.2 Site Investigation

A single season field investigation was completed to describe in general, the natural and physical setting of the subject property with a focus on natural heritage features and to identify any potential SAR or their habitat that may exist at the subject property.

Field investigations completed in support of this SAR report are outlined in Table 2.1 below.

Table 2.1 Summary of Field Investigations

Date	Time	Weather	Purpose
April 15, 2024	12:30-14:30	1°C, 0% cloud cover, Beaufort 0, no precipitation.	SAR Investigation

The field investigation was completed by traversing the entire stretch of the 1930 m proposed project path of construction while documenting habitat conditions and the presence/ absence of SAR and their regulated habitat.

Photographs of relevant site features are provided in Appendix B.

3.0 RESULTS

3.1 Desktop Screening Results

Results of the desktop screening exercise are summarized in Table 3.1 below. The desktop screening exercise identified the potential for six avian, two herptile, three mammalian, and one plant SAR within the project area.

Species	ESA Status	Habitat Use	Probability of Occurrence On-Site or Within Study Area	Rationale
Avian				
Bank Swallow	Threatened	Colonial nester, burrows in eroding silt, to sand banks, sand pit walls, etc.	Moderate	Suitable nesting habitat may be present within the study area. NHIC and eBird ccurrence data for species within 1 km of site. Species not observed during field investigation. No historical nests observed within project area.
Barn Swallow	Special Concern	Nests in barns and other semi-open structures. Forages over open fields and meadows.	Moderate	Suitable nesting habitat may be present within the study area. eBird ccurrence data for species within 1 km of site. Species not observed during field investigation. No historical nests observed within project area.
Bobolink	Threatened	Nests in dense tall grass fields and meadows, low tolerance for woody vegetation.	Moderate	Agricultural fields within project area may provide suitable grassland habitat to support species presence. NHIC occurrence records confirm its presence within 1 km of site. Species not observed during field investigation.
Canada Warbler	Special Concern	Prefers wet forests with dense shrub layers	Low	Prefered wet forest habitat may be present on-site. No recent records within 1 km of proposed project area. Species not observed during field investigation.
Cerulean Warbler	Threatened	Prefers mature deciduous forest habitat.	Low	Preferred mature deciduous forest habitat is not present on-site or within study area. Species not observed during field investigation.
Chimney Swift	Threatened	Nests in traditional-style open brick chimneys.	Low	eBird indicates presence of species within 1 km of site. No suitable nesting structures within 1 km of site. Species not encountered during the field investigation.
Common Nighthawk	Special Concern	Nests in a variety of open sites: beaches, fields and grave rooftops.	Low	Suitable open habitat present in the study area. No recent occurrence records within 1 km of site. Species not observed during field investigation.
Eastern Meadowlark	Threatened	Nests and forages in dense tall grass fields and meadows, higher tolerance to woody vegetation.	Moderate	Agricultural fields within project area may provide suitable grassland habitat to support species presence. NHIC occurrence records confirm its presence within 1 km of site. Species not observed during field investigation.
Eastern Whip-poor-will	Threatened	Nests on the ground in open deciduous or mixed woodlands with little underbrush, and bedrock outcrops.	Low	Site lacks suitable open deciduous or mixed woodlands to support species presence. No recent records within 1 km of the proposed project area. Species not observed during the field investigation.
Eastern Wood-Pewee	Special Concern	Woodland species, often found near clearings and edge habitat.	Moderate	Potentially suitable wooded edge habitat is scattered throughout the project area. NHIC occurrence data for species within 1 km of site. Species not observed during the field investigation.
Evening Grosbeak	Special Concern	Nests in trees or large shrubs, preference to large coniferous forests, will use deciduous. Overwinters in Ottawa.	Low	Site lacks suitable stands of coniferous or deciduous forest to support species presence. No recent occurrence records for species within 1 km of site. Species not observed during the field investigation.
Golden Eagle	Endangered	Nests on remote, bedrock cliffs, overlooking large burns, lakes or tundras	Low	Preferred nesting habitat is not present on-site or within the study area. No occurrence records within 1 km of site. Species not observed during the field investigation.
Golden-winged Warbler	Special Concern	Ground nesting, edge species. Breeds in successional scrub habitats surrounded by forests.	Low	The study area lacks a suitable combination of successional scrub habitat adjacent to forest. No occurrence records within 1 km of site. Species not observed during the field investigation.
Grasshopper Sparrow	Special Concern	Ground-nesting grassland species. Prefers fields with low sparse vegetation on sand, alvars or poor soils.	Low	Potentially suitable habitat within the agricultural fields of the greater study area. No occurrence records within 1 km of site. Species was not observed during the field investigation.
Henslow's Sparrow	Endangered	Prefers open, moist, tallgrass fields.	Low	Preferred moist tallgrass fields not present on-site or within the study area. No occurrence records within 1 km of site. Species not observed during field investigation.
Least Bittern	Threatened	Prefers marshes, shrub swamps, usually near cattails	Low	Suitable marsh or swamp habitat not present within the study area. No recent observations within 1 km of the proposed project site. Species not observed during the field investigation.
Lesser Yellowlegs	Threatened	Ottawa Migrant. Breeding is limited to Alaska and northern Canada. During winter and migration usess coastal salt marshes, estuaries and ponds, lakes, freshwater wetlands, anthropogenic wetlands.	Moderate	Potentially suitable open aquatic habitat on-site. eBird occurrence records for species within the Caselman Lagoons. Species not observed during the field investigation.
Loggerhead Shrike	Endangered	Prefers grazed pastures with short grass and scattered shrubs, especially hawthorn.	Low	Study area lacks suitable grazed pasture habitat. Preferred shrub species not observed within study area. No occurrence records within 1 km of site. Species not observed during the field investigation.
Olive-sided Flycatcher	Special Concern	Forest edge species, forages in open areas from high vantage points in trees.	Low	Potentially suitable wooded edge habitat is scattered throughout the project area. No occurrence records for species within 1 km of site. Species not observed during the field investigation.
Peregrine Falcon	Special Concern	Nests on cliffs near water and on more anthropogenic structures such as tall buildings, bridges, and smokestacks.	Low	Preferred nesting structures not present on-site or within the study area. Recent occurrence records for species within study area are primarily associated with the South Nation River. Species not observed during field investigation.
Red-headed Woodpecker	Endangered	Prefers open deciduous woodlands, particularly those dominated by oak and beech.	Low	Site lacks suitable stands of woodland habitat. No occurrence records for species within 1 km of site. Species was not observed during the field investigation.
Red-necked Phalarope	Special Concern	Ottawa Migrant. Breeds around lakes, bogs, and marshes in the Arctic tundra or tundra-forest boundary.	Moderate	Potentially suitable open aquatic habitat on-site. eBird occurrence records for species within the Caselman Lagoons. Species not observed during the field investigation.
Rusty Blackbird	Special Concern	Wet wooded or shrubby areas (nests at edges of Boreal wetlands)	Low	No wet wooded or shrubby areas within the immediate study area. No recent occurrence records for species within 1 km of site. Species was not observed during the field investigation.
Short-eared Owl	Threatened	Ground nester, prefers open habitats, fields and marshes.	Low	Suitable open habitat present in the study area. No recent occurrence records within 1 km of site. Species not observed during field investigation.
Wood Thrush	Special Concern	Prefers deciduous or mixed woodlands.	Moderate	Potentially suitable wooded edge habitat is scattered throughout the project area. NHIC occurrence data for species within 1 km of site. Species not observed during the field investigation.
Mammalian				
Eastern small-footed Myotis	Endangered	Roosts in rock crevices, barns and sheds. Overwinters in abandoned mines. Summer habitats are poorly understood in Ontario, elsewhere prefers to roost in open, sunny rocky habitat and occasionally in buildings (Humphrey, 2017).	Moderate	Study area may contain suitable roosting habitat. No recent reports within 1 km of the proposed project site. Species not observed during field investigation.
Little Brown Myotis	Endangered	Maternal colonies known to use buildings, may also roost in trees during summer. Affinity towards anthropogenic structures for summer roosting habitat and exhibit high site fidelity (Environment Canada, 2015).	Moderate	Study area may contain suitable roosting habitat. Research-grade iNaturalist observations confirm its presence within 1 km of the proposed project site. Species not observed during field investigation.
Northern myotis (Northern Long-eared Bat)	Endangered	Occurs throughout eastern North America in associated with Boreal forests. Roosts mainly in trees, occasionally anthropogenic structures during summer (Environment Canada, 2015). Overwinters in caves and abandoned mines.	Low	Species affinity is for Boreal forests and species rarely roosts in anthropogenic structures. No recent observations within 1 km of the proposed project site.
Tri-colored Bat	Endangered	Roosts in trees, rock crevices and occasionally buildings during summer. Overwinters in caves and mines.	Moderate	Study area may contain suitable roosting habitat. No recent reports within 1 km of the proposed project site. Species not observed during field investigation.

Species	ESA Status	Habitat Use	Probability of Occurrence On-Site or Within Study Area	Rationale
Reptilian				
Blanding's Turtle	Threatened	Inhabits quiet lakes, streams and wetlands with abundant emergent vegetation. Frequently occurs in adjacent upland forests.	Low	Study area likely to provide suitable habitat conditions to support species activity. No occurrence records within 1 km of site. Species not observed during field investigation.
Eastern Musk Turtle	Special Concern	Wetlands. Highly aquatic habtiats.	Low	Study area lacks suitable habitat conditions to support species activity. No occurrence records within 1 km of site. Species not observed during field investigation.
Eastern Ribbonsnake	Special Concern	Marshy edfes of wetlands and watercourses.	Low	Suitable habitat may be present within the study area. No occurrence records within 1 km of site. Species not observed during field investigation.
Northern Map Turtle	Special Concern	Highly aquatic species, found only in lakes and large rivers.	Moderate	Study area lacks suitable habitat conditions to support species activity. No occurrence records within 1 km of site. Species not observed during field investigation.
Snapping Turtle	Special Concern	Highly aquatic species, found in a wide variety of wetlands, water bodies and watercourses.	Low	Study area likely to provide suitable habitat conditions to support species activity. No occurrence records within 1 km of site. Species not observed during field investigation.
Spotted Turtle	Endangered	Secretive wetland species.	Low	Study area lacks suitable habitat conditions to support species activity. No occurrence records within 1 km of site. Species not observed during field investigation.
Wood Turtle	Endangered	Primarily terrestrial forest species. Associated with clear, gravelly streams.	Low	Study area lacks suitable habitat conditions to support species activity. No occurrence records within 1 km of site. Species not observed during field investigation.
Plants				
American Ginseng	Endangered	Rich, moist, relatively mature deciduous forests.	Low	Study area lacks suitable habitat to support species activity. No occurrence records within 1 km of site. Species not observed during the field investigation.
Black Ash	Endangered	Predominantly a wetland species, found in swamps, floodplains and fens.	Low	Study area lacks suitable wetland habitat to support species presence. No occurrence records within 1 km of site. Species not observed during the field investigation.
Butternut	Endangered	Inhabits a wide range of habitats including upland and lowland deciduous and mixed forests.	Low	Suitable wooded hedgrow habitat on-site to support species presence. No occurrence records within 1 km of site. Species not observed during the field investigation.
Lichens				
Pale-bellied Frost Lichen	Endangered	Grows on the bark of hardwood trees such as white ash, black walnut, American elm and ironwood. Can also be found growing on fence posts and boulders.	Low	Study area may provide suitable habitat. No recent occurrence records with 1 km of the site. Species was not observed during field investigation.
Fish				
American Eel	Endangered	Primarily nocturnal, hiding in soft substrate or submerged vegetation during the day.	Moderate	Suitable habitat present within the South Nation River to support species presence. NHIC indicates occurrence records for the species within 1 km of site. Species was not observed during the field investigation.
Bridle Shiner	Special Concern	Prefers clear water with abundant vegetation over silty or sandy vegetation	Low	The South Nation River may provide suitable habitat conditions. No occurrence records for the species within 1 km of site. Species was not observed during the field investigation.
Channel Darter	Special Concern	Prefers clear water with abundant vegetation over silty or sandy vegetation	Low	The South Nation River may provide suitable habitat conditions. No occurrence records for the species within 1 km of site. Species was not observed during the field investigation.
Lake Sturgeon	Endangered	Large lakes and rivers. Forages in cool water, 4-9m deep over soft substrates. Spawns in shallower, fast-flowing areas over rocks or gravel.	Low	The South Nation River may provide suitable habitat conditions. No occurrence records for the species within 1 km of site. Species was not observed during the field investigation.
Northern Brook Lamprey	Special Concern	Prefers shallow areas with warm water. Larvae burrows in soft substrate for up to 7 years.	Low	The South Nation River may provide suitable habitat conditions. No occurrence records for the species within 1 km of site. Species was not observed during the field investigation.
River Redhorse	Special Concern	Prefers fast-flowing, clear rivers over rocky substrate	Low	The South Nation River may provide suitable habitat conditions. No occurrence records for the species within 1 km of site. Species was not observed during the field investigation.
Silver Lamprey	Special Concern	Larvae live 4-7 years in burrows, preference to soft substrate.	Low	The South Nation River may provide suitable habitat conditions. No occurrence records for the species within 1 km of site. Species was not observed during the field investigation.
Insects				
Bogbean Buckmoth	Endangered	Preferred food plant is bog bean, present in a variety of wetlands including bogs, swamps and fens.	Low	Preferred wetland habitat not present on-site. Species nor prefered food source observed during field investigation.
Gypsy Cuckoo Bumble Bee	Endangered	Inhabits a wide range of habitats: open meadows, agricultural and urban areas, boreal forests and woodlands.	Low	Preferred habitat may be present within the study area. No recent occurrence records within 1 km of site. Species not observed during field investigation.
Monarch Butterfly	Special Concern	Caterpillars require milkweed plants confined to meadow and open areas. Adult butterflies use more diverse habitat with a variety of wildflowers	Low	Preferred habitat may be present within the study area. No recent occurrence records within 1 km of site. Species not observed during field investigation.
Mottled Duskywing	Endangered	Larval food plant (New Jersey Tea) found in sandy areas and alvars.	Low	Preferred habitat not present within the study area. Species not observed during field investigation.
Nine-spotted Lady Beetle	Endangered	Habitat generalist	Low	No recent occurrence reports in the area, thought to be locally extirpated. Species not observed during field investigation.
Rusty-patched Bumble Bee	Endangered	Habitat generalist	Low	Preferred habitat may be present within the study area. No recent occurrence records within 1 km of site. Species not observed during field investigation.
Transverse Lady Beetle	Endangered	Habitat generalist	Low	No new records of traverse lady beetle in Ontario, species thought to be absent in former habitats.
West Virginia White Butterfly	Special Concern	Requires mature moist deciduous woods with larval host plant toothwort.	Low	Necessary vegetation and toothwort plant not present on-site or within study area.
Yellow-banded Bumble Bee	Special Concern	Habitat generalist; mixed woodlands, variety of open habitat	Low	Potentially suitable foraging habitat for yellow-banded bumble bee occurs on-site. No recent observations within 1 km of the proposed project site. Species not observed during field investigation.

3.2 Vegetation Communities

Vegetation communities within the study area consisted of agricultural fields, constructed green space (schoolyard, open parks), open aquatic (lagoons), and wooded hedgerow areas.

Wooded areas on-site were associated with the successional scrub fields adjacent to the schoolyard, riparian areas, and scattered field hedgerows. Tree species included common riparian associates and species common to disturbed environments, including Manitoba maple (*Acer negundo*), alder (*Alnus* sp.), American elm (*Ulmus americana*), trembling aspen (*Populus tremuloides*), and hawthorn (*Crataegus sp.*). A stand of dead green ash (*Fraxinus pennsylvanica)* was observed between GEMTEC borehole BH23-4 and BH24-3. No black ash (*Fraxinus nigra*) or butternut (*Juglans cinerea*) were observed during the field investigation.

Most of the proposed construction area is made up of constructed green space (parkspace) and agricultural fields. The field north of Laurier Street appear to be in active use for row crop agriculture. The fields south of Laurier were not in use at the time of the site investigation, being occupied by grass species from the previous growing season. Some areas of field have given way to successional scrub habitat dominated by young Manitoba maple, alternate-leaved dogwood (*Cornus alternifolia*), and red osier dogwood (*Cornus sericea*).

Aquatic vegetation at the time of the site investigation was mostly limited to green algal growths within the South Nation River and the Casselman Lagoons. Pondweed was observed within small sections of pooling associated with a drainage swale running north-south between GEMTEC boreholes BH24-5 and BH24-6.

3.3 Wildlife

During field investigations within the project area, all terrestrial wildlife, including calls and sign, were recorded. Due to the urban nature of the Study Area, it is anticipated that most wildlife species in the area are limited to those that tolerate humans and cultural landscapes. Birds recorded have been assumed to be residents/breeding. Table 3.2 lists all wildlife species identified during field investigations.

Table 3.2 – Incidental Wildlife Observations

Common Name	Scientific Name	S-Rank	ESA Status
Birds			
American goldfinch	*Carduelis tristis*	S5B	-
American wigeon	*Turdus migratorius*	S4	-
Canada goose	*Branta canadensis*	S5	-
Hooded merganser	*Lophodytes cucullatus*	S5B, S5N	-
Killdeer	*Charadrius vociferus*	S5B, S5N	-
Mallard	*Anas platyrhynchos*	S5	-
Northern flicker	*Colaptes auratus*	S4B	-
Red-winged blackbird	*Agelaius phoeniceus*	S4	-
Savannah sparrow	*Passerculus sandwichensis*	S4B	-
Song sparrow	*Melospiza melodia*	S5B	-
Tree swallow	*Tachycineta bicolor*	S4B	-
Woodcock	*Scolopax minor*	S4B	-
Herptile			
Spring peeper	*Pseudacris crucifer*	S5	-
Western chorus frog	*Pseudacris maculata pop. 1*	S3	-
Mammalian			
American beaver	*Castor canadensis*	S5	-
Eastern gray squirrel	*Sciurus carolinensis*	S5	-
Groundhog	*Marmota monax*	S5	-
Muskrat	*Ondatra zibethicus*	S5	-

Notes:
S/N** – range of uncertainty about the status of the species
S1/N1 – Critically Imperiled: At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
S2/N2 – Imperiled: At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
S3/N3 – Vulnerable: At moderate risk of extirpation in the jurisdiction due to a restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors
S4/N4 – Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern because of local recent declines, threats, or other factors.
S5/N5 – Secure: At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations, or occurrences, with little to no concern from declines or threats.
SE – Introduced species.

No fish were directly observed within the South Nation River and Casselman Lagoons. Fish habitat is further discussed in Section 3.4.

No other evidence of wildlife activity was observed within or immediately adjacent to the proposed path of construction.

3.4 Fish Habitat

Targeted surveys for fish were not completed as part of the project scope; however, an aquatic habitat investigation to characterize the South Nation River was completed Fish habitat within the project area consists of the South Nation River at the western limits, and the Casselman Lagoons at the eastern end. Both these features are mapped as fish habitat on the UCPR Official Plan (UCPR, 2022).

The South Nation River originates approximately 90 kilometres (km) south of the project area, where it begins as a drainage point for the wetlands north of Brockville. From the study area the South Nation River continues to flow for another 55 km northeastwards before discharging into the Ottawa River, north of Plantagenet. Within the confines of the study area, the South Nation River can be characterized as being a mostly naturalized watercourse flowing through the Village of Casselman.

The South Nation River was noted to have a constant, moderate to fast flow. The channel varied greatly in width, being mostly channelized as it occurs adjacent to the project area. Water within the confines of the study area was noted as mostly clear with some brown discoloration from suspended sediments. Water depths were not measured at the time of the field investigation. The South Nation River had an abundance of in-water structure, including fallen trees and logs, undercut banks, large cobble, and exposed roots. No barriers to fish passage were noted during the field investigation.

The Casselman Lagoons are indicated as offline ponds that provide fish habitat by the UCPR Official Plan (UCPR, 2022). Water within the confines of the study area was noted as brownish discolored due to suspended sediments and organic material. Water depths were not measured during the field investigation. The banks of the lagoons were densely vegetated with reeds and cattail. The Casselman Lagoons appear to lack in-water structure and habitat complexity.

Presently, the full scope of the work needed to complete the replacement of the Casselman sewer main is unknown. However, the installation of the emergency outflow pipe is known to occur below the high water mark for the South nation River, a Department of Fisheries and Oceans (DFO) Request for Project Review (RfR) has been submitted to DFO prior to any in-water work to ensure the project avoids the Hazardous Alteration, Disturbance or Destruction of fish habitat (HADD). A Letter of Advice (LoA) has not been provided by the DFO at the time of this reports writing.

3.5 Species at Risk

As outlined in the Endangered Species Act (Ontario, 2007), only species listed as threatened or endangered and their general habitat receive automatic protection. When a species-specific recovery strategy is developed, a specific habitat regulation will be established, which eventually replaces the automatic habitat protection.

As discussed in Section 3.1, the desktop screening exercise identified the following SAR as being found or potentially found within the Study Area: bank swallow (*Riparia riparia,* THR), bobolink (*Dolichonyx oryzivorus*, THR), eastern meadowlark (*Sturnella magna,* THR), lesser yellowlegs (*Tringa flavipes*, THR), eastern small-footed myotis (*Myotis leibii*, END), little brown myotis (*Myotis lucifugus*, END), and tri-colored Bat (*Perimyotis subflavus*, END).

No floral or faunal SAR were observed within the project area during the completed site investigation. Additional species of conservation concern (Special Concern and/or rare species)

were identified during the background reviewing including eastern wood-pewee (*Contopus virens*), red-necked phalarope (*Phalaropus lobatus*), wood thrush (*Hylocichla mustelina*), and northern map turtle (*Graptemys geographica*). Species of Special Concern and their habitat do not receive protection under the ESA.

Potential impacts associated with the proposed project to SAR identified as having a moderate potential to occur on-site, are discussed in the subsections below.

3.5.1 Bank Swallow

Bank swallow is a small insectivorous songbird that nest in burrow colonies built into natural and human-made settings that are vertical faces of silt and sand deposits. No suitable nesting habitat was observed within the proposed project area. However, the combination of open aquatic and field habitats within the project area may provide suitable foraging opportunities. As vegetation grubbing and excavation will be required as part of the proposed works, the project is likely to result in a minor, temporary loss of suitable riparian habitat within the Casselman Lagoons.

Potential indirect impacts include temporary increased disturbances due to human presence and elevated noise levels during construction. However, given the scope of the project, impacts to bank swallow and their habitat are anticipated to be minimal and temporary. Furthermore, it is anticipated that the disturbed areas of suitable habitat within the Casselman Lagoons will return to a state that continues to support bank swallow foraging needs.

The project area does not provide regulated bank swallow habitat. Any potential impacts to individual bank swallow can be mitigated by implementing the avoidance and mitigation measures outlined in Section 4 below. If all of the avoidance and mitigation measures outlined in Section 4 below are enacted, no further permitting is required for the protection of bank swallow.

3.5.2 Bobolink and Eastern Meadowlark

Bobolink nest and forage in dense tall grass fields and have a low tolerance for woody vegetation, while eastern meadowlark nest and forage in dense tall grass fields and have a higher tolerance for woody vegetation.

Potential nesting and foraging habitats for bobolink and eastern meadowlark are limited to the nearby open agricultural fields, which may see a minor loss during construction. However, it is anticipated that direct impacts will be temporary in nature, as the areas of disturbed agricultural field will return to use as potentially suitable crop habitat.

Potential indirect impacts include temporary increased disturbances due to human presence and elevated noise levels during construction. However, overall impacts to bobolink and eastern meadowlark and their habitats are anticipated to be minimal and temporary.

Avoidance and mitigation measures to prevent harm to avian SAR and associated habitat are provided in Section 4.

3.5.3 Lesser Yellowlegs

Lesser yellowlegs is a small shorebird that migrates between its breeding grounds in northern Canada and its overwintering grounds across the southern United States, central, and south America. The species utilizes coastal salt marshes, estuaries and ponds, lakes, freshwater wetlands, and anthropogenic wetlands such as flooded rice fields and sewage lagoons as habitat.

Potential foraging habitats for migratory lesser yellowlegs are concentrated around the South Nation River and the Casselman Lagoons. As vegetation grubbing and excavation will be required as part of the proposed works, the project is likely to result in a minor loss of suitable riparian within the Casselman Lagoons.

Potential indirect impacts include temporary increased disturbances due to human presence and elevated noise levels during construction. However, given the scope of the project, impacts to lesser yellowlegs and their habitat are anticipated to be minimal and temporary. Furthermore, it is anticipated that the disturbed areas of suitable habitat within the Casselman Lagoons will return to a state that continues to support lesser yellowlegs foraging habitat needs.

Any potential impacts to individual lesser yellowlegs can be mitigated by implementing the avoidance and mitigation measures outlined in Section 4 below. As long as all of the avoidance and mitigation measures outlined in Section 4 below are enacted, no further permitting is required for the protection of lesser yellowlegs.

3.5.4 Eastern Small-Footed Myotis, Little Brown Myotis, and Tri-Colored Bat

Three mammalian SAR were identified as having a moderate potential to occur on-site or within the project area. Eastern small-footed myotis (*Myotis leibii*), little brown myotis (*Myotis lucifugus*), and tri-colored bat (*Perimyotis subflavus*) are provincially listed as Endangered under the ESA.

Potential roosting habitats for SAR Bats is limited to the wooded hedgerow treed areas and adjacent anthropogenic buildings and structures. Construction through the treed areas in the immediate vicinity of the proposed pathway are likely to require some form of vegetation clearing. None of the anthropogenic buildings and structures are within the scope of the proposed work area, nor are they anticipated to be impacted by the proposed project.

As the project is anticipated to require some vegetation clearing in the form of tree removal, direct impacts to SAR Bats may include the minor loss of wooded habitat and possible roosting trees.

Potential indirect impacts include temporary increased disturbances due to human presence and elevated noise levels during construction, and habitat encroachment. However, given the scope

of the project, impacts to eastern small-footed myotis, little brown myotis, and tri-colored bat are anticipated to be minimal and temporary.

Avoidance and mitigation measures to prevent harm to eastern small-footed myotis, little brown myotis, and tri-colored bat and associated habitat are provided in Section 4.

4.0 AVOIDANCE AND MITIGATION MEASURES

The following avoidance and mitigation measures are recommended in order to minimize or avoid, to the greatest extent possible, the potential impacts from the proposed rehabilitation on the local environment, including potential SAR and their habitat:

- Vegetation removal should occur outside of March 15 to November 30 to avoid the key breeding bird period and bat summer active season. The timing windows provides protection of migratory birds and roosting bats and avoids contravention of the Migratory Bird Convention Act and Endangered Species Act. If vegetation clearing activities must take place during the timing window, then a nest and acoustic survey shall be conducted by a qualified professional prior to any vegetation removal on-site.
- Active bird nests are protected under the ESA and the Migratory Bird Convention Act (MBCA). Active bird nests may not be disturbed, damaged or removed. Any disturbance, damage or removal of active bird nests must wait until after the active season, when they are no longer being used.
- To protect trees identified to be retained during construction, the Critical Root Zone (CRZ) should be identified and fenced. The CRZ is defined as 10 cm from the base of the tree for every centimetre in diameter of the tree trunk at breast height.
- Perform daily pre-work sweeps of the construction area to ensure no species at risk are present and to remove any wildlife from inside the construction area.
- Erosion and sediment control should be prepared by a qualified person and measures implemented prior to any construction works and be maintained until all disturbed ground has been permanently stabilized.
- During construction if any SAR are identified on-site all work should stop and a qualified professional and the MECP should be contacted for next steps.

In addition to the measures above, sediment fencing/exclusion fencing is recommended to be installed at the up gradient and downgradient edge of the construction area for the protection of wildlife SAR, protection of fish and fish habitat, and protection of water quality within the watercourse.

- To protect migrating turtles associated with the South Nation River and the Casselman Lagoons, exclusion fencing should be installed around the entire construction area prior to construction commencing to prohibit the movement of turtles into the construction area. Following installation of exclusion fencing, a qualified professional should be retained to sweep the construction area to remove any turtles which may be trapped within the exclusion fencing.
    - Exclusion fencing should follow the protocols outlined in the Species at Risk Branch: Best Practices Technical Note: Reptile and Amphibian Exclusion Fencing Version 1.1 (MNRF, July 2013).

    - The current best practices for turtle fencing provisions indicate that fencing must be up by May 1st and is to remain in place until October 15. Should fencing not be in place prior to May 1st, individual turtles have the potential occupy the project area and nest, resulting in project delays.
- To prevent turtles nesting within the construction zone, all stockpiled materials should be covered with a geotextile between May 1 and August 1 of any year.
- To protect potential travel corridors and migrating turtles, all existing riparian zone vegetation along the watercourse and lagoons should be maintained to the extent as possible to provide protection and cover, and if removed, reinstated following construction.

The following general mitigation measures are recommended for the protection of water quality, fish and fish habitat:

- If any in-water work is required as part of the culvert replacement work, or if work is unable to avoid HADD of fish habitat, a Request for Review must be submitted to the Department of Fisheries and Oceans prior to any in-water work is commenced to ensure that the project avoids death to fish and the harmful alteration, disruption and destruction of fish habitat.
- To protect warm-water fish habitat, no in-water work is permitted between May 1 to July 15.
- Light-duty sediment fencing shall be installed along the downgradient edge of the construction area with accordance to the Ontario Provincial Standard Specification and Drawing (OPSD) 219.110.
- Install straw bale flow check dams as per OPSD 219.180 at the outlet and downstream of the channel.
- Maintain as much of the natural vegetation as possible within and around the construction project. Post-construction, degraded vegetation within the disturbed areas should be replaced by planting of local or non-invasive plant species, or seeded, as to prevent further soil erosion.
- Reinstate disturbed areas with native vegetation post-construction.
- Schedule work to avoid wet, windy, and rainy periods.
- Maintain erosion and sediment control measures until all disturbed ground has been permanently stabilized, suspended sediment has resettled, and runoff water is clear.
- To protect aquatic habitat for turtle and fish species, machinery should be maintained in good working condition and all machinery should be fueled a minimum of 30 m from the high-water mark.

If applicable, the following mitigation measures are recommended for the protection of fish entrapped within the working area:

- For the protection and safe release of fish entrapped within the working area, a fish salvage effort is recommended.
- Fish salvage efforts are to be conducted only by trained professionals under the applicable permitting from the Ontario Ministry of Natural Resources and Forestry (MNRF).
- A fish salvage effort is to be conducted after the in-water working area has been satisfactorily sectioned off, but prior to any dewatering or other in-water construction activities, unless otherwise approved.

5.0 CLOSURE

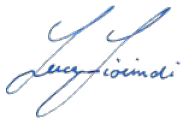
This Species at Risk Assessment was completed based on our understanding of the project at the time of writing. The investigation undertaken by GEMTEC with respect to this report and any conclusions or recommendations made in this report reflect the best judgements of GEMTEC based on the site conditions observed during the investigations undertaken at the date(s) identified in the report and on the information available at the time the report was prepared.

This report has been prepared for the application noted and it is based, in part, on visual observations made at the site, all as described in the report. Unless otherwise stated, the findings contained in this report cannot be extrapolated or extended to previous or future site conditions or for portions of the site that were unavailable for direct investigation.

Should new information become available during future work or other studies, GEMTEC should be requested to review the information and, if necessary, re-assess the conclusions presented herein.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Sincerely,



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Zachary Anderson, B.Sc.
Biologist

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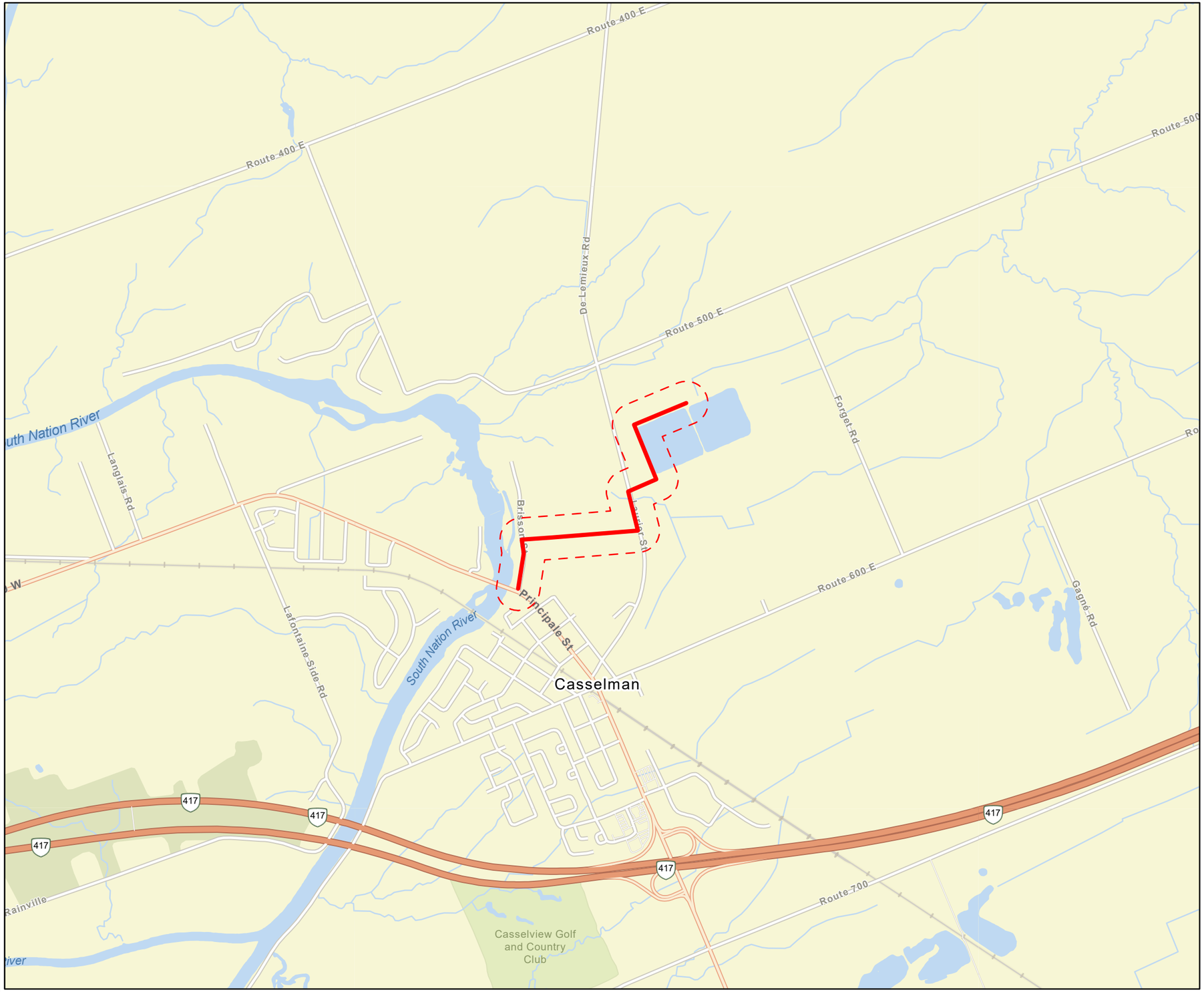
APPENDIX A

Report Figures

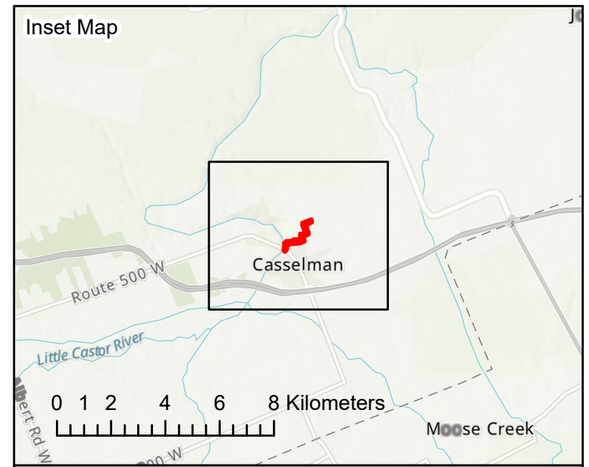
Figure A.1 – Site Location

Figure A.2 – Site Layout



Legend

- Project Area
- Study Area



Scale
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J.L. Richards & Associates Limited	100117.051

Location
Casselman Main Sewage Pumping Station (SPS)
Casselman, Ontario

Drwn By:	Chkd By:	Site Location
LF	ZA	

Date: December 2024	Rev.	Figure: A.1
© Queen's Printer for Ontario	0	

Coordinate System: NAD 1983 UTM Zone 18N
Service Layer Credits: World Street Map: Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada
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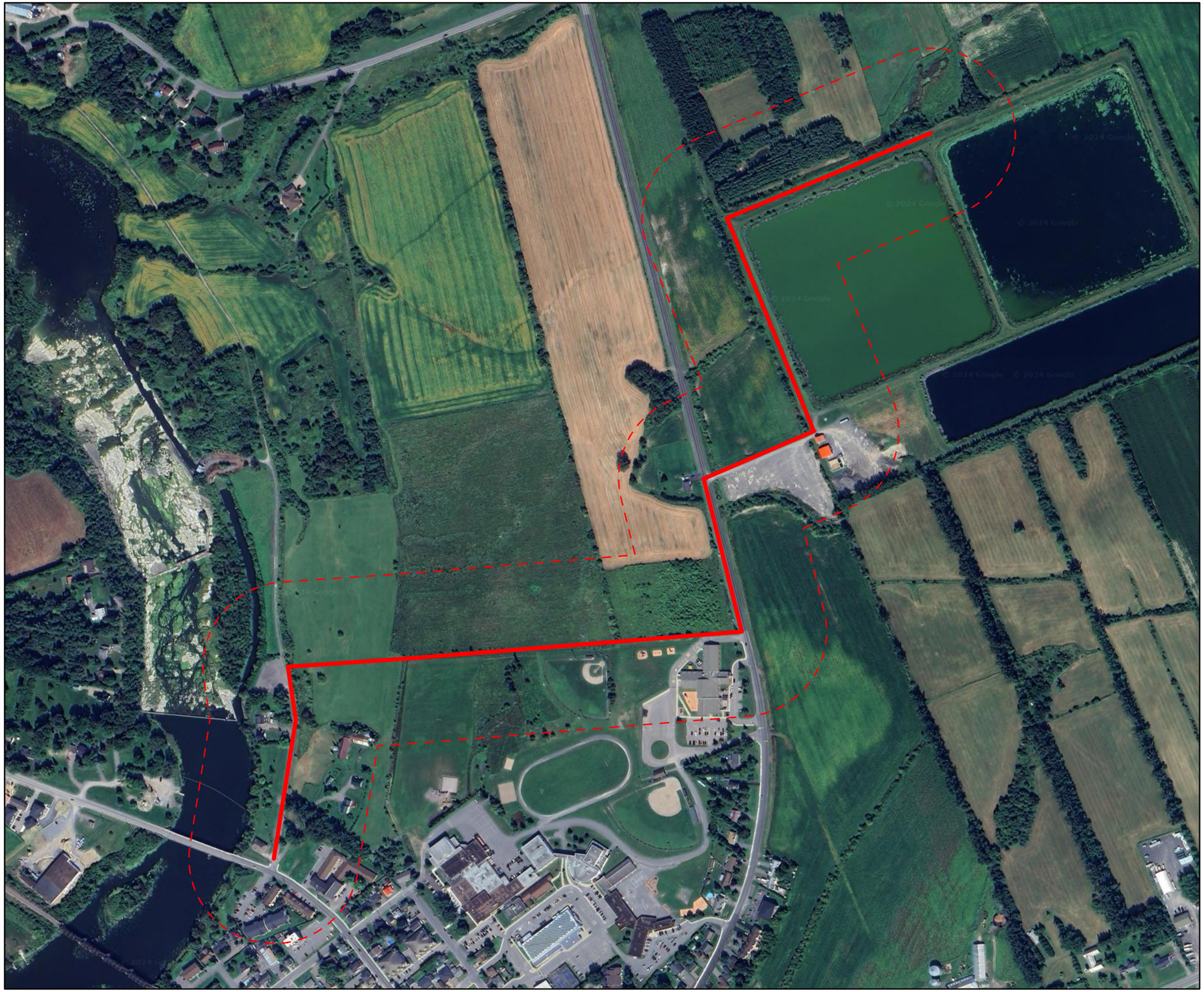

Legend

- Project Area
- Study Area

Scale
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Project: 100117.051

Location
Casselman Main Sewage Pumping Station (SPS)
Casselman, Ontario

Drwn By:	Chkd By:	
LF	ZA	Site Layout

Date: December 2024

Rev. 0

Figure: A.2

Coordinate System: NAD 1983 UTM Zone 18N
Service Layer Credits: Tiled service layer: © OpenStreetMap (and) contributors, CC-BY-SA
Hybrid Reference Layer: Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

APPENDIX B

Site Visit Photographs

Site Photograph 1 – Laurier Street

Site Photograph 2 – Agricultural Field North of Laurier Street

Site Photograph 3 – Lot of Casselman Lagoons

Site Photograph 4 – Muskrat Den (1 of 2)

GEMTEC Consulting Engineers and Scientists	Project SAR Screening Assessment Casselman Main Sewage Pumping Station Upgrades, Casselman, Ontario	**APPENDIX B**	**Site Photographs**
		File No. 100117.051	

Site Photograph 5 – Berm between Casselman Lagoons

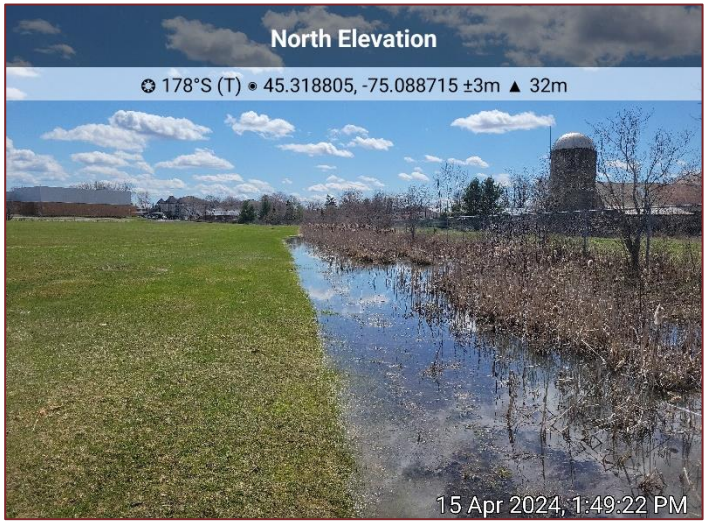
Site Photograph 6 – Berm between Casselman Lagoons

Site Photograph 7 – Casselman Lagoons

Site Photograph 8 – Muskrat Den (2 of 2)

Site Photograph 9 – Grass Field adjacent to Schoolyard

Site Photograph 10 – Grass Field adjacent to Schoolyard



Site Photograph 11 – Pooling in Swale

Site Photograph 12 – Cervid Tracks along Riparian Area

Site Photograph 13 – Stand of Green Ash – Brisson Street

Site Photograph 14 – Green Ash

Site Photograph 15 – Groundhog Den (BH24-5)

Site Photograph 16 – Parkspace – Brisson Street

Site Photograph 13 – South Nation River

Site Photograph 14 – South Nation River (ii)

Site Photograph 15 – Pumping Station

Site Photograph 16 – Pumping Station (ii)

experience • knowledge • integrity

civil	civil
geotechnical	géotechnique
environmental	environnement
structural	structures
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité

Appendix No. 6

Equipment Assessment Reports

Intervention report

2024-11-04 Casselman, ON

Task to be accomplished:

- **Cont-Flo inspection**
- **RPW Rotopac Inspection**

Observation:

(Cont-Flo)

- **Right and left rail switches need to be replaced**

➢ **The comb has teeth that are bent and should probably be replaced**

➢ **The polypropylene rake and the leather must be changed**

➢ **The grating is broken and needs to be replaced.**

➢ **The rack and pinion must be replaced.**

➢ **The chariot wheels should also be replaced if they have not been replaced in awhile**

Observation:

(Rotopac RPW)

- **The perforated hopper is deformed.**
- **The leather, the anti-rotation bars also need to be replaced. The screw is starting to wear out also**
- **The bearing box could not be checked due to too much waste accumulating. So we weren't able to inspect its condition**

Conclusion:

- **The Contflo is 20 years old. The structure still is in decent condition. With some part replacements, it can continue to be used for several more years.**
- **The compactor situation is more urgent. The perforated trough is damaged and usually once that needs to be replaced, it's not really worth it compared to replacing the full compactor. You can just replace the wear parts, but that damaged trough needs to be addressed relatively soon.**