



# SPECIFICATIONS

**SOLICITATION #:** 16-22051

**BUILDING:** S-77 100 Sussex Drive, Ottawa, Ontario  
S-77 Water Main Replacement and Parking Lot/Service Road Rehabilitation

**PROJECT:** S77-5226

**PROJECT #:** June 2016

**Date:**



# **SPECIFICATION**

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## Directions to the Ottawa Research Facilities – Sussex Drive

100 Sussex Drive  
Ottawa, Ontario, Canada

### **NRC Steacie Institute for Molecular Sciences (NRC-SIMS)**

Tel: 613-991-5419

### **NRC Institute for Biological Sciences (NRC-IBS)**

Tel: 613-993-5812

### **By Road, from the OTTAWA International Airport**

1. Take the AIRPORT PARKWAY
2. Drive on the AIRPORT PARKWAY as it becomes BRONSON ST
3. Turn RIGHT at LAURIER ST
4. From LAURIER ST turn LEFT on BAY ST
5. From BAY ST, turn RIGHT on WELLINGTON ST
6. Pass the Parliament buildings and turn LEFT on SUSSEX DR
7. Drive on SUSSEX DR until you see the NRC-CNRC sign at 100 Sussex, on your LEFT.

### **By Road, from MONTREAL RD FACILITIES**

1. Drive Southwest on MONTREAL RD (REGIONAL ROUTE 34 W)
2. Turn RIGHT onto VANIER PARKWAY / REGIONAL ROUTE 19 N
3. Turn LEFT onto ST PATRICK ST (You will cross the ST PATRICK ST BRIDGE)
4. Turn RIGHT on KING EDWARD AVE/REGIONAL ROUTE 99 N
5. Take EXIT to the RIGHT to SUSSEX
6. At the LIGHT, go straight into 100 Sussex PARKING lot.





- |  |   |   |   |   |
|--|---|---|---|---|
|  NRC Institute    |  Major HWY     |  Airport       |  Ferry       |  Metro |
|  Trans Canada HWY |  Secondary HWY |  Train Station |  Bus Station |   |

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National Research Council    Conseil national de recherches  
Canada                            Canada

Administrative Services        Direction des services  
& Property management       administratif et gestion  
Branch (ASPM)                    de l'immobilier (SAGI)

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## Construction Tender Form

**Project Identification**        **S77- Water Main Replacement and Parking Lot/Service Road  
Rehabilitation**

**Tender No.:**        **16-22051**

**1.2 Business Name and Address of Tenderer**

**Name** \_\_\_\_\_

**Address** \_\_\_\_\_

\_\_\_\_\_

**Contact Person(Print Name)** \_\_\_\_\_

**Telephone** (\_\_\_\_\_) \_\_\_\_\_        **Fax:** (\_\_\_\_\_) \_\_\_\_\_

**1.3 Offer**

I/We the Tenderer, hereby offer to Her Majesty the Queen in Right of Canada (hereinafter referred to as "Her Majesty") represented by the National Research Council Canada to perform and complete the work for the above named project in accordance with the Plans and Specifications and other Tender Documents, at the place and in the manner set out therein for the Total Tender Amount (to be expressed in numbers only) of: \$ \_\_\_\_\_ . \_\_\_\_\_ **in lawful money of Canada (excluding GST/HST)**

The above amount is inclusive of all applicable (\*) Federal, Provincial and Municipal taxes except that in the event of a change in any tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property, that occurs

- .1        after the date this tender was mailed or delivered, or
- .2        if this tender is revised, after the date of the last revision

the amount of this offer shall be decreased or decreased in the manner provided for in GC22 of the General Conditions of the Contract Documents.

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Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)

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### **1.3.1 Offer (continued)**

(\*) For the purpose of this tender, the Goods and Services Tax (GST) is not to be considered as an applicable tax.

In the province of Quebec, the Quebec Sales Tax is not to be included in the tender amount because the Federal Government is exempt from this tax. Tenderers shall make arrangements directly with the provincial Revenue Department to recover any tax they may pay on good and servives acquired in the performance of this contract. However, tenderers should include in their tender amount Quebec Sales Tax for which an Input Tax Refund is not available.

### **1.4 Acceptance and Entry into Contract**

I/We undertake, within fourteen (14) days of notification of acceptance of my/our offer, to sign a contract for the performance of the work provided I/we are notified, by the Department, of the acceptance of my/our offer within 30 days of the tender closing date.

### **1.5 Construction Time**

I/We Agree to complete the work within the time stipulated in the specification from the date of notification of acceptance of my/our offer.

### **1.6 Bid Security**

I/We herewith enclose tender security in accordance with Article 5 of the General Instruction to Tenderers.

I/We understand that if a security deposit is furnished as tender security and if I/we refuse to enter into a contract when called upon to do so, my/our security deposit shall be forfeited but the Minister may, if it is in the public interest, waive the right of Her Majesty to forfeit the security deposit.

I/We understand that if the security furnished is not in the approved form as described in Article 5 of the General Instructions to Tenderers, my/our tender is subject to disqualification.

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**1.7 Contract Security**

Within fourteen (14) days after receipt of written notification of the acceptance of my/our offer, I/we will furnish contract security in accordance with the Contract Conditions "F" of the Contract Documents.

I/We understand that the contract security referred to herein, if provided in the form of a bill of exchange, will be deposited into the Consolidated Revenue Fund of Canada.

**1.8 Appendices**

This Tender Form includes Appendix No. 1.

**1.9 Addenda**

The Total Tender Amount provides for the Work described in the following Addenda:

NUMBER	DATE	NUMBER	DATE

**(Tenderers shall enter numbers and dates of addenda)**



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National Research Council Canada	Conseil national de recherches Canada
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Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)
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**1.10 Execution of Tender**

The Tenderer shall refer to Article 2 of the General Instructions to Tenderers.

**SIGNED, ATTESTED TO AND DELIVERED on the \_\_\_\_\_ day of  
\_\_\_\_\_ on behalf of**

\_\_\_\_\_  
(Type or print the business name of the Tenderer)

AUTHORIZED SIGNATORY (IES)

\_\_\_\_\_  
(Signature of Signatory)

\_\_\_\_\_  
(Print name & Title of Signatory)

\_\_\_\_\_  
(Signature of Signatory)

\_\_\_\_\_  
(Print name & Title of Signatory)

**SEAL**

## Project #3924: S-77 Watermain Replacement & Parking Lot Rehabilitation

### Appendix 1 – TENDER BID FORM

### Cost Breakdown Information

**NOTE:** This Appendix must be completed and submitted with the Construction Tender Form. Contract will be awarded to the lowest total contract price.

#### 1.1 Pricing Schedule

Contractor **MUST** provide all-inclusive cost for each of the following items of the project.

Item	Cost (excluding GST/HST) In lawful money of Canada
1. General: Mobilization, Erosion & Sediment Control Measures	\$
2. Removals	\$
3. Storm Works	\$
4. Watermain	\$
5. Curbs & Sidewalks	\$
6. Grading, Excavation, Landscaping, Grounds R-instatement & Paving	\$

7. Site Lighting & Electrical Works	\$
8. Sanitary Works (works related to drawings C04 & C05 and associated related electrical requirements as indicated on E02 & E03)	\$
9. Miscellaneous Other Related Works	\$
<b>Total Firm Lump Sum Price:</b>	\$

End of Appendix 1

## BUY AND SELL NOTICE

### S-77 Water Main Replacement and Parking Lot/Service Road Rehabilitation

The National Research Council Canada, 100 Sussex Drive, Ottawa, ON has a requirement for a project that includes:

Work under this contract covers the water main replacement, repairs to storm sewers, parking lot re-construction and interception and treatment of the sanitary discharge.

#### 1. GENERAL

Questions regarding any aspect of the project are to be addressed to and answered only by the Departmental Representative (or his designate) or the Contracting Authority.

Any information received other than from the Departmental Representative (or his designate) or the Contracting Authority will be disregarded when awarding the contract and during construction.

Firms intending to submit tenders on this project should obtain tender documents through the Buyandsell.gc.ca TMA services provider. Addenda, when issued, will be available from the Buyandsell.gc.ca TMA service provider. Firms that elect to base their bids on tender documents obtained from other sources do so at their own risk and will be solely responsible to inform the tender calling authority of their intention to bid. Tender packages are not available for distribution on the actual day of tender closing.

#### 2. MANDATORY SITE VISIT

It is mandatory that the bidder attends one of the site visits at the designated date and time. At least one representative from proponents that intend to bid must attend.

The site visits will be held on July 19<sup>th</sup> and July 21<sup>st</sup>, 2016 at **9:00**. Meet Don Seabrook at Building S-77, Main Entrance, 100 Sussex Drive, Ottawa, ON. Bidders who, for any reason, cannot attend at the specified date and time will not be given an alternative appointment to view the site and their tenders, therefore, will be considered as non-responsive. **NO EXCEPTIONS WILL BE MADE.**

As proof of attendance, at the site visit, the Contracting Authority will have an Attendance Form which **MUST** be signed by the bidder's representative. It is the responsibility of all bidders to ensure they have signed the Mandatory Site Visit Attendance form prior to leaving the site. Proposals submitted by bidders who have not attended the site visit or failed to sign the Attendance Form will be deemed non-responsive.

#### 3. CLOSING DATE

Closing date is August 10<sup>th</sup>, 2016 at 14:00.

#### 4. TENDER RESULTS

Following the Tender closing, the tender results will be sent by facsimile to all Contractors who submitted a tender

## 5. SECURITY REQUIREMENT FOR CANADIAN CONTRACTORS

### 5.1 MANDATORY SECURITY REQUIREMENT:

This procurement contains a mandatory security requirement as follows:

- 1 The Contractor must, at all times during the performance of the Contract, hold a valid Designated Organization Screening (DOS), issued by the Canadian Industrial Security Director (CISD), Public Works Government Services Canada.
- 2 The Contractor personnel requiring access to sensitive work site(s) must EACH hold a valid RELIABILITY STATUS, granted or approved by CISD/PWGSC.
- 3 The Contractor must comply with the provisions of the:
  - a. Security Requirements Checklist attached at Appendix "D"
  - b. Industrial Security Manual (Latest Edition) available at: <http://ssi-iss.tpsgc-pwgsc.gc.ca/ssi-iss-services/eso-oss-eng.html>

### 5.2 VERIFICATION OF SECURITY CLEARANCE AT BID CLOSING

- 1 The Bidder must hold a valid Designated Organization Screening (DOS) issued by the Canadian Industrial Security Directorate (CISD), Public Works and Government Services Canada (PWGSC), **TO BE INCLUDED WITH THEIR TENDER OR PROVIDED WITHIN 48 HOURS FROM THE DATE AND TIME OF TENDER CLOSING.** Verifications will be made through CISD to confirm the security clearance status of the Bidder. Failure to comply with this requirement will render the bid non-compliant and no further consideration will be given to the bid.
- 2 Within 72 hours of tender closing, the General Contractor must name all of his sub-contractors, each of whom **must hold a valid RELIABILITY STATUS**, granted or approved by CISD/PWGSC, or any other Federal Department or Agency along with the names and birthdates or security clearance certificate numbers of all personnel who will be assigned to the project.
- 3 It is to be noted that any subcontractor required to perform any part of the work during the performance of the subsequent contract must also adhere to the mandatory security requirement of the contract. As well, no personnel without the required level of security will be allowed on site. It will be the responsibility of the successful bidder to ensure that the security requirement is met throughout the performance of the contract. The Crown will not be held liable or accountable for any delays or additional costs associated with the contractor's non-compliance to the mandatory security requirement. Failure to comply with the mandatory security requirement will be grounds for being declared in default of contract.
- 4 For any enquiries concerning the project security requirement during the bidding period, the Bidder/Tenderer must contact the Security Officer @ 613-993-8956.

## 6.0 WSIB (WORKPLACE SAFETY AND INSURANCE BOARD)

- 1 All Bidders must provide a valid WSIB certificate with their Tender or prior to contract award.

## 7.0 OFFICE OF THE PROCUREMENT OMBUDSMAN

### 1 Dispute Resolution Services

The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will, on request or consent of the parties to participate in an alternative dispute resolution process to resolve any dispute between the parties respecting the interpretation or application of a term and condition of this contract and their consent to bear the cost of such process, provide to the parties a proposal for an alternative dispute resolution process to resolve their dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at [boa.opo@boa-opo.gc.ca](mailto:boa.opo@boa-opo.gc.ca).

### 2 Contract Administration

The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will review a complaint filed by [*the supplier or the contractor or the name of the entity awarded this contract*] respecting administration of this contract if the requirements of Subsection 22.2(1) of the *Department of Public Works and Government Services Act* and Sections 15 and 16 of the *Procurement Ombudsman Regulations* have been met, and the interpretation and application of the terms and conditions and the scope of the work of this contract are not in dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at [boa.opo@boa-opo.gc.ca](mailto:boa.opo@boa-opo.gc.ca).

- 3 The Office of the Procurement Ombudsman (OPO) was established by the Government of Canada to provide an independent avenue for suppliers to raise complaints regarding the award of contracts under \$25,000 for goods and under \$100,000 for services. You have the option of raising issues or concerns regarding the solicitation, or the award resulting from it, with the OPO by contacting them by telephone at 1-866-734-5169 or by e-mail at [boa.opo@boa-opo.gc.ca](mailto:boa.opo@boa-opo.gc.ca). You can also obtain more information on the OPO services available to you at their website at [www.opo-boa.gc.ca](http://www.opo-boa.gc.ca).

The Departmental Representative or his designate for this project is: **Don Seabrook**  
Telephone: **613 991-9874**.

Contracting Authority for this project is: **Alain Leroux** [alain.leroux@nrc-cnrc.gc.ca](mailto:alain.leroux@nrc-cnrc.gc.ca)  
Telephone: **613 991-9980**.

## INSTRUCTIONS TO BIDDERS

### Article 1 – Receipt of Tender

- 1a) Tenders must be received not later than the specified tender closing time. Tenders received after this time are invalid and shall not be considered, regardless of any reason for their late arrival.
- 1b) A letter of printed telecommunication from a bidder quoting a price shall not be considered as a valid tender unless a formal tender has been received on the prescribed Tender Form.
- 1c) Bidders may amend their tenders by letter or printed telecommunication provided that such amendments are received not later than the specified tender closing time.
- 1d) Any amendments to the tender which are transmitted by telefax must be signed and must clearly identify the tenderer.

All such amendments are to be addressed to:  
National Research Council of Canada  
Alain Leroux, Senior Contracting Officer  
Building M-22  
Montreal Road, Ottawa, Ontario  
K1A 0R6

Fax: (613) 991-3297

### Article 2 – Tender Form & Qualifications

- 1) All tenders must be submitted on the Construction Tender Form and the tender must be signed in compliance with the following requirements:
  - a) Limited Company: The full names of the Company and the name(s) and status of the authorized signing officer(s) must be printed in the space provided for that purpose. The signature(s) of the authorized officer(s) and the corporate seal must be affixed.
  - b) Partnership: The firm name and the name(s) of the person(s) signing must be printed in the space provided. One or more of the partners must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.
  - c) Sole Proprietorship : The business name and the name of the sole proprietor must be printed in the space provided. The sole proprietor must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.
- 2) Any alterations in the printed part of the Construction Tender Form or failure to provide the information requested therein, may render the tender invalid.
- 3) All space in the Construction Tender Form must be completed and any handwritten or typewritten corrections to the parts so completed must be initialed immediately to the side of the corrections by the person or persons executing the tender on behalf of the the tenderer.
- 4) Tenders must be based on the plans, specifications and tender documents provided.

### Article 3 - Contract

- 1) The Contractor will be required to sign a contract similar to the Standard Contract Form for Fixed Price Construction Contracts, a blank specimen of which is enclosed in the package for reference purposes.

### Article 4 – Tender Destination

- 1a) Tenders are to be submitted in sealed envelopes to:  
National Research Council Canada  
Administrative Services and Property Management Branch  
1200 Montreal Road  
Building M-22  
Ottawa, ON  
K1A 0R6

Endorsed "Tender for (insert title of work as it appears in the drawings and specifications)" and must bear the name and address of the tenderer.

- 1b) Unless otherwise specified, the only documents required to be submitted with the tender are the Tender form and the Bid Security.

### Article 5 - Security

- 1a) Bid Security is required and must be submitted in one of the following forms:
  - i) a certified cheque payable to the Receiver General for Canada and drawn on a member of the Canadian Payments Association or a local cooperative credit society that is a member of a central cooperative credit society having membership in the Canadian Payments Association; **OR**
  - ii) bonds of the Government of Canada, or bonds unconditionally guaranteed as to principal and interest by the Government of Canada; **OR**
  - iii) a bid bond.
- 1b) Regardless of the Bid Security submitted, it should never be more than \$250,000 maximum, calculated at 10% of the first \$250,000 of the tendered price, plus 5% of any amount in excess of \$250,000.
- 2a) Bid Security shall accompany each tender or, if forwarded separately from the tender, shall be provided not later than the specified tender closing time. Bid Security must be in the **ORIGINAL** form. Fax or photocopies and **NOT** acceptable. **FAILURE TO PROVIDE THE REQUIRED BID SECURITY SHALL INVALIDATE THE TENDER.**
- 2b) If the tender is not accepted, the Bid Security submitted pursuant to Article 8 shall be returned to the tenderer.
- 3a) The successful tenderer is required to provide security within 14 days of receiving notice of tender acceptance. The tenderer must furnish **EITHER**:
  - i) a Security Deposit as described in 1(b) above together with a Labour and Material Payment Bond in the amount of at least 50% of the amount payable under the contract, **OR**



- ii) a Performance Bond and a Labour and Material Payment Bond – each in the amount of 50% of the amount payable under the contract.
- 3b) Should it not be possible to obtain a Labour Material Payment Bond as required under 3(a) above, on making application thereof to at least two acceptable Bonding Companies, an additional Security Deposit of a straight 10% of the amount payable under the contract must be furnished.
- 3c) Where a tender has been accompanied by a Security Deposit, as described in 1(b) above, the amount of the Security Deposit required under 3(a) above may be reduced by the amount of the Security Deposit which accompanied the tender.
- 3d) Bonds must be in an approved form and from the companies whose

bonds are acceptable to the Government of Canada. Samples of the approved form of Bid Bond, Performance Bond and Labour and Material Payment Bond and a list of acceptable Bonding Companies may be obtained from the Contracting Officer, National Research Council, Building M-22, Montreal Road, Ottawa, Ontario, K1A 0R6.

#### Article 6 – Interest On Security Deposits

- 1) Tenderers are notified that they must make their own arrangements with their bankers as to the interest, if any, on the amount of the certified cheque accompanying their tender. The Council will not pay interest on said cheque pending the awarding of the contract nor be responsible for the payments of interest under any arrangement made by the tenderers.

#### Article 7 – Sales Tax

- 1) The amount of the tender shall include all taxes as levied under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act or the Customs Tariff, in force or applicable at the time.
- 2) In Quebec, the Provincial Sales Tax should not be included in the Tender Price as the Federal Government is exempt. Tenderers should contact the Provincial Revenue Minister to recover all taxes paid for goods and services rendered under this contract.

Tenderers must include in their Tender Price the amount of Provincial Sales Tax for which the exemption does not apply.

#### Article 8 – Examination of Site

- 1) All parties tendering shall examine the sites of the proposed work before sending in their tender and make themselves thoroughly acquainted with the same and obtain for themselves any and all information that may be necessary for the proper carrying out of the Contract. No after claim will be allowed or entertained for any work or material that may be requisite and necessary for the proper execution and completion of this Contract with the exception of that provided for under GC 35 in the General Conditions of the General Specification.

Article 9 – Discrepancies, Omissions, Etc.

- 1a) Bidders finding discrepancies in, or omissions from, drawings, specifications or other documents, or having any doubt as to the meaning or intent of any part thereof, should at once notify the Engineer who will send written instructions or explanation to all bidders.
- 1b) Neither the Engineer nor the Council will be responsible for oral instructions.
- 1c) Addenda or corrections issued during the time of the bidding shall be covered in the proposal. However, the contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work and made prior to the date of the contract.

Article 10 – No additional Payments for Increased Costs

- 1) The only other adjustments in the contract price allowed are those specified in the General Conditions of the General Specification. The contract price will not be amended for change in freight rates, exchange rates, wage rates or cost of materials, plant or services.

Article 11 – Awards

- 1a) The Council reserves the power and right to reject tenders received from parties who cannot show a reasonable acquaintance with and preparation for the proper performance of the class of work herein specified and shown on plans. Evidence of such competence must be furnished by the tenderers if required to do so.
- 1b) A tenderer may be required to furnish to the Contracting Office, National Research Council of Canada, Building M-22, 1200 Montreal Road, Ottawa, Ontario, K1A 0R6, Canada, unsigned copies of the insurance requirements as covered by the Insurance Conditions of the General Specification.
- 1c) The Council does not bind itself to accept the lowest or any tender.

Article 12 – Harmonized Sales Tax

- 1) The Harmonized Sales Tax (HST) which is now in effect shall be considered an applicable tax for the purpose of this tender. However, the bidder shall NOT include any amount in the bid price for said HST. The successful contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount certified for payment under the Contract in addition to the amount certified for payment under the Contract and will therefore not affect the Contract Price. The Contractor agrees to remit any HST collected or due to Revenue Canada.

## Non-resident contractors

RST guide 804

Published August 2006

ISBN: 1-4249-2007-8 (Print), **1-4249-2009-4 (PDF)**, **1-4249-2008-6 (HTML)**

## Publication Archived

**Notice to the reader: For Retail Sales Tax (RST)** – On July 1, 2010 the 13 per cent Harmonized Sales Tax (HST) took effect in Ontario replacing the existing provincial Retail Sales Tax (RST) and combining it with the federal Goods and Services Tax (GST). As a result, RST provisions described on this page and in other publications ended on June 30, 2010.

Effective July 1, 2010 this publication was archived for RST purposes **only**. Use caution when you refer to it, since it reflects the law in force for RST at the time it was released and may no longer apply.

- The information in this Guide explains the Retail Sales Tax (RST) responsibilities of a non-resident contractor who is awarded a construction contract to perform work in Ontario and their Ontario customers. Please note that this Guide replaces the previous version dated March 2001.

## Non-Resident Contractor Defined

A non-resident contractor is a contractor located outside Ontario who has been awarded a construction contract to perform work in Ontario, and who has not maintained a permanent place of business in Ontario continuously for twelve months immediately prior to signing the contract, or which is not a company incorporated under the laws of Ontario. A construction contract is a contract for the erection, remodelling or repair of a building or other structure on land.

A contractor is a person who is in the business of constructing, altering, repairing or improving real property and includes, but is not limited to,

1. a general contractor and subcontractor,
2. a carpenter, bricklayer, stonemason, electrician, plasterer, plumber, painter, decorator, paver, and bridge builder,
3. a sheet metal, tile and terrazzo, heating, air conditioning, insulation, ventilating, papering, road, roofing and cement contractor, who installs or incorporates items into real property. (See RST [Guide 206 - Real Property and Fixtures](#)).

## Registration and Guarantee Deposit

Non-resident contractors who are awarded a construction contract in Ontario are required to register with the Ministry of Finance (ministry), Centralized Programs Unit and post a guarantee equal to 4 per cent of the total of each Ontario contract. The guarantee can be paid in cash, by certified cheque (payable to the Minister of Finance), letter of credit or by a guarantee bond.

To register with the ministry and to obtain further information on posting a guarantee, contractors should contact the ministry's Centralized Programs Unit, 33 King Street West, PO Box 623, Oshawa, Ontario, L1H 8H7, toll-free 1 866 ONT-TAXS (1 866 668-8297) or fax to 905 435-3617.

Non-resident contractors who sell taxable goods on a supply only basis to Ontario customers, or provide taxable services in Ontario, may obtain a regular Vendor Permit to collect and remit RST on their sales. Non-resident contractors who have been issued a regular Vendor Permit must still register separately with the ministry and post a guarantee if they are awarded a construction contract in Ontario.

## Letter of Compliance

After receiving the guarantee, the ministry mails out two copies of a "letter of compliance" to the contractor certifying the Retail Sales Tax (RST) requirements have been met. Contractors must give a copy of the letter to their customers.

If a copy of the compliance letter is not provided, the customer must withhold 4 per cent of all amounts payable to the non resident contractor and pay the withheld amounts to the Minister of Finance (minister). Details relating to the contract should be sent along with the payments to the Centralized Programs Unit. Customers may give the minister a guarantee bond equal to 4 per cent of the total contract price instead of making the 4 per cent payments.

Note: Customers who do not follow these requirements may be held liable for 4 per cent of all amounts payable to the non resident contractor or any other amount that the Ministry deems to be the RST payable resulting from the performance of the contract.

## Calculation of RST

### ***Fair Value***

RST is payable on the "fair value" of materials, purchased or brought into Ontario, to be used for work performed in Ontario. "Fair value" includes:

- the purchase price in Canadian funds;
- all charges by the supplier for handling and delivery, and
- any federal customs duties and excise taxes paid (but not the federal Goods and Services Tax (GST)).

Contractors are also required to pay RST to Ontario suppliers on the purchase, rental or lease of taxable services, materials, machinery, or equipment.

### ***Machinery and Equipment - Leased***

If machinery or equipment is leased from a supplier outside Ontario and brought into the province, RST is payable on the lease payments for the period the machinery or equipment is in Ontario.

### ***Machinery and Equipment - Owned by Contractor***

If machinery or equipment is owned by the contractor, RST may be calculated in one of the following ways:

- a. If a contractor brings machinery and equipment into Ontario for less than 12 months' use, RST is to be calculated using the following formula:

$$1/36 \times \text{net book value at date of import} \times \text{number of months in Ontario} \times \text{tax rate}$$

For the purpose of this formula, RST is payable for each month or part of a month that the goods are in Ontario. A month is considered 31 consecutive days and a part month is considered more than 12 days. The RST payable is based on the number of days the machinery and equipment are located in Ontario and not the number of days the items are actually used.

Example: Equipment is brought into Ontario on March 28 and taken out on May 8. The items were in the province for 41 days. RST is payable on the first 31 days' temporary stay in Ontario vs. use of the equipment. Since the remainder (10 days) is not considered part of a month, no RST is payable on this portion.

- b. If, at the time the goods are brought into Ontario, it is expected that the machinery or equipment will be in Ontario for more than twelve months, contractors must pay Retail Sales Tax (RST) on the following basis:

net book value at date of import × tax rate

If, at the time of import, the length of time is not known, vendors may use the formula under (a). If they later find it necessary to keep the machinery and equipment in Ontario for more than 12 months, the RST paid under (a) may be deducted from the RST payable under (b).

Using formula (a) or (b) above, contractors will calculate and remit the RST payable on the return that is filed when the contract is finished.

(See Completion of Contract section)

## M a n u f a c t u r i n g   f o r   O w n   U s e

Contractors may need to manufacture items, such as doors and windows, for their construction contracts. Manufacturing is work done in a factory away from a construction site, or in a mobile unit or workshop that is on or near the construction site. Manufacturing occurs when raw materials are changed into manufactured goods for use in real property contracts.

Contractors are considered to be manufacturing contractors if they produce goods:

1. for their own use in real property contracts, and
2. the manufactured cost of the goods is more than \$50,000 a year.

(See RST Guide 401 - Manufacturing Contractors)

## C o n t r a c t s   w i t h   t h e   F e d e r a l   G o v e r n m e n t

Where a non-resident contractor enters into a construction contract with the federal government, for the construction of a building and/or the installation of equipment, the nature of the equipment will determine whether the contract should be let on a tax-included or tax excluded basis.

Contracts for the construction of a building and the installation of equipment that directly services that building (i.e., elevators, escalators, light fixtures, central heating and air conditioning, etc.) should be tendered on a tax -included basis. Contractors are the consumers of the materials used in fulfilling these contracts and must pay or account for RST on the materials used to complete the contracts. There is NO exemption just because the contract is with the federal government.

Contracts for the installation of equipment that becomes a fixture and does not directly service a building (i.e., material handling equipment, production machinery, communication equipment, training equipment) may be tendered on a tax-excluded basis. Contractors engaged in contracts of this nature are permitted to make tax exempt purchases of such equipment by issuing a valid Purchase Exemption Certificate (PEC) to their supplier. Only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC.

## E x e m p t i o n s

Contractors may supply and install equipment or materials for certain customers that may be entitled to an exemption from RST (e.g., manufacturers, Indian band councils, farmers and diplomatic organizations). The equipment or materials, when installed, becomes real property if it is permanently attached to land, or a fixture if it is permanently attached to a building or real property structure. Since

contractors are liable for RST, they should contact the ministry to find out if the customer qualifies for exemption before tendering the contract on a tax-excluded basis.

## Status Indians, Indian Bands and Band Councils

Non-resident contractors may purchase building materials exempt from Retail Sales Tax (RST) for certain buildings and structures situated on reserves. The cost of such projects must be paid by the band council, and the buildings must provide a community service for the reserve. Contracts for the construction of an exempt community building project should be made on an RST-excluded basis. Non-resident contractors may purchase the materials exempt from RST by providing suppliers with a valid Purchase Exemption Certificate (PEC). As noted previously, only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC. (See RST Guide [204 - Purchase Exemption Certificates](#)).

Non-resident contractors must pay RST on items purchased for incorporation into a building or structure built for individual status Indians on a reserve. (See RST [Guide 808 - Status Indians, Indian Bands and Band Councils](#)).

### Completion of Contract

When a contract is completed, non-resident contractors who were required to post a guarantee must complete a [Non-Resident Contractor Retail Sales Tax Return \[PDF - 92 KB\]](#) that is provided by the ministry.

If a contractor's guarantee was given in cash or by certified cheque, the amount of the deposit can be deducted from the RST liability owed by the contractor. If the liability is greater than the deposit, the amount remaining must be paid by the contractor. If the deposit is more than the liability, the contractor will receive a refund.

If a guarantee bond was posted instead of cash, the bond will be discharged once the RST liability is paid in full.

All returns are subject to audit.

### Legislative References

- Retail Sales Tax Act, Subsections 19(2) and 39(3)(4) and (5)
- Regulation 1012 under the Act, Subsections 15.3(1)(2)(5)(6) and (7)
- Regulation 1013 under the Act, Sections 1 and 3

### For More Information

The information contained in this publication is only a guideline. For more information, please contact the Ontario Ministry of Finance at 1 866 ONT-TAXS (1 866 668-8297) or visit our website at [ontario.ca/finance](http://ontario.ca/finance).

## **Acceptable Bonding Companies**

Published September 2010

The following is a list of insurance companies whose bonds may be accepted as security by the government.

### **1. Canadian Companies**

- ACE INA Insurance
- Allstate Insurance Company of Canada
- Ascentus Insurance Ltd. (Surety only)
- Aviva Insurance Company of Canada
- AXA Insurance (Canada)
- AXA Pacific Insurance Company
- Canadian Northern Shield Insurance Company
- Certas Direct Insurance Company (Surety only)
- Chartis Insurance Company of Canada (formerly AIG Commercial Insurance Company of Canada)
- Chubb Insurance Company of Canada
- Commonwealth Insurance Company
- Co-operators General Insurance Company
- CUMIS General Insurance Company
- The Dominion of Canada General Insurance Company
- Echelon General Insurance Company (Surety only)
- Economical Mutual Insurance Company
- Elite Insurance Company
- Everest Insurance Company of Canada
- Federated Insurance Company of Canada
- Federation Insurance Company of Canada
- Gore Mutual Insurance Company
- Grain Insurance and Guarantee Company
- The Guarantee Company of North America
- Industrial Alliance Pacific General Insurance Corporation
- Intact Insurance Company
- Jevco Insurance Company (Surety only)
- Lombard General Insurance Company of Canada
- Lombard Insurance Company
- Markel Insurance Company of Canada
- The Missisquoi Insurance Company
- The Nordic Insurance Company of Canada
- The North Waterloo Farmers Mutual Insurance Company (Fidelity only)
- Novex Insurance Company (Fidelity only)
- The Personal Insurance Company
- Pilot Insurance Company
- Quebec Assurance Company
- Royal & Sun Alliance Insurance Company of Canada
- Saskatchewan Mutual Insurance Company
- Scottish & York Insurance Co. Limited
- The Sovereign General Insurance Company
- TD General Insurance Company
- Temple Insurance Company
- Traders General Insurance Company

- Travelers Guarantee Company of Canada
- Trisura Guarantee Insurance Company
- The Wawanesa Mutual Insurance Company
- Waterloo Insurance Company
- Western Assurance Company
- Western Surety Company

## 2. Provincial Companies

Surety bonds issued by the following companies may be accepted provided that the contract of suretyship was executed in a province in which the company is licensed to do business as indicated in brackets.

- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- ALPHA, Compagnie d'Assurances Inc. (Que.)
- Canada West Insurance Company (Ont., Man., Sask, Alta., B.C., N.W.T.) (Surety only)
- The Canadian Union Assurance Company (Que.)
- La Capitale General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., Que.(Surety only), Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Coachman Insurance Company (Ont.)
- Continental Casualty Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- GCAN Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- The Insurance Company of Prince Edward Island (N.S., P.E.I., N.B.)
- Kingsway General Insurance Company (N.S., N.B., Que., Ont., Man., Sask., Alta., and B.C.)
- Liberty Mutual Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Manitoba Public Insurance Corporation (Man.)
- Norgroupe Assurance Générales Inc.
- Orleans General Insurance Company (N.B., Que., Ont.)
- Saskatchewan Government Insurance Office (Sask.)
- SGI CANADA Insurance Services Ltd. (Ont., Man., Sask., Alta.)
- L'Unique General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., N.B., Que.(Surety only), Ont.(Surety only), Man., Sask., Alta., B.C.(Surety only), Nun., N.W.T., Yuk.)

## 3. Foreign Companies

- Aspen Insurance UK Limited
- Compagnie Française d'Assurance pour le Commerce Extérieur (Fidelity only)
- Eagle Star Insurance Company Limited
- Ecclesiastical Insurance Office Public Limited Company (Fidelity only)
- Lloyd's Underwriters
- Mitsui Sumitomo Insurance Company, Limited
- NIPPONKOA Insurance Company, Limited
- Sompo Japan Insurance Inc.
- Tokio Marine & Nichido Fire Insurance Co., Ltd.
- XL Insurance Company Limited (Surety only)
- Zurich Insurance Company Ltd



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## Articles of Agreement

Standard Construction Contract – Articles of Agreement  
(23/01/2002)

- A1 Contract Documents
- A2 Date of Completion of Work and Description of Work
- A3 Contract Amount
- A4 Contractor's Address
- A5 Unit Price Table

---

## Articles of Agreement

These Articles of Agreement made in duplicate this      day of      .

Between

**Her Majesty the Queen**, in right of Canada (referred to in the contract documents as “ Her Majesty”) represented by the National Research Council Canada (referred to in the contract documents as the “Council”)

and

(referred to in the contract documents as the “Contractor”)

Witness that in consideration for the mutual promises and obligations contained in the contract, Her Majesty and the Contractor covenant and agree as follows:

A1      Contract Documents

**(23/01/2002)**

1.1      Subject to A1.4 and A1.5, the documents forming the contract between Her Majesty and the Contractor, referred to herein as the contract documents, are

1.1.1    these Articles of Agreement,

1.1.2    the document attached hereto, marked “A” and entitled “Plans and Specifications”, referred to herein as the Plans and Specifications,

1.1.3    the document attached hereto, marked “B” and entitled “Terms of Payment”, referred to herein as the Terms of Payment,

1.1.4    the document attached hereto, marked “C” and entitled “General Conditions”, referred to herein as the General Conditions,

1.1.5    the document attached hereto, marked “D” and entitled “Labour Conditions”, referred to herein as the Labour Conditions,

1.1.6    the document attached hereto, marked “E” and entitled “Insurance Conditions”, referred to herein as the Insurance Conditions,

1.1.7    the document attached hereto, marked “F” and entitled “Contract Security Conditions”, referred to herein as the Contract Security Conditions, and

1.1.8    any amendment or variation of the contract documents that is made in accordance with the General Conditions.

1.1.9    the document entitled Fair Wage Schedules for Federal Construction Contracts referred to herein as Fair Wage Schedules

1.1.10

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## Articles of Agreement

The Council hereby designates \_\_\_\_\_ of \_\_\_\_\_ of the Government of Canada as the Engineer for the purposes of the contract, and for all purposes of or incidental to the contract, the Engineer's address shall be deemed to be:

### 1.2 In the contract

1.3.1 "Fixed Price Arrangement" means that part of the contract that prescribes a lump sum as payment for performance of the work to which it relates; and

1.3.2 "Unit Price Arrangement" means that part of the contract that prescribes the product of a price multiplied by a number of units of measurement of a class as payment for performance of the work to which it relates.

1.3 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Unit Price Arrangement are not applicable to any part of the work to which a Fixed Price Arrangement is applicable.

1.4 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Fixed Price Arrangement are not applicable to any part of the work to which a Unit Price Arrangement is applicable.

### A2 Date of Completion of Work and Description of Work

**(23/01/2002)**

2.1 The contractor shall, between the date of these Articles of Agreement and the \_\_\_\_\_, \_\_\_\_\_, in the careful and workmanlike manner, diligently perform and complete the following work:

which work is more particularly described in the Plans and Specifications.

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## Articles of Agreement

### A3 Contract Amount

**(23/01/2002)**

- 3.1 Subject to any increase, decrease, deduction, reduction or set-off that may be made under the Contract, Her Majesty shall pay the Contractor at the times and in the manner that is set out or referred to in the Terms of Payment
- 3.1.1 the sum of \_\_\_\_\_ (GST/HST extra), in consideration for the performance of the work or the part thereof that is subject to Fixed Price Arrangement, and
- 3.1.2 a sum that is equal to the aggregate of the products of the number of units of Measurement of each class of labour, plant and material that is set out in a Final Certificate of Measurement referred to in GC44.8 multiplied in each case by the appropriate unit price that is set out in the Unit Price Table in consideration for the performance of the work or the part thereof that is subject to a Unit Price Arrangement.
- 3.2 For the information and guidance of the Contractor and the persons administering the contract on behalf of Her Majesty, but not so as to constitute a warranty , representation or undertaking of any nature by either party, it is estimated that the total amount payable by Her Majesty to the Contractor for the part of the work to which a Unit Price Arrangement is applicable will be approximately \$N/A
- 3.3 A3.1.1 is applicable only to a Fixed Price Arrangement.
- 3.4 A3.1.2 and A3.2 applicable only to a Unit Price Arrangement.

### A4 Contractor's Address

**(23/01/2002)**

- 4.1 For all purposes of or incidental to the contract, the Contractor's address shall be deemed to be:

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**Articles of Agreement**

A5 Unit Price Table

**(23/01/2002)**

5.1 Her Majesty and the Contractor agree that the following table is the Unit Price Table for the purposes of the contract.

<b>Column 1</b> Item	<b>Column 2</b> Class of Labour Plant  Or Material	<b>Column 3</b> Unit of Measurement	<b>Column 4</b> Estimated Total Quantity	<b>Column 5</b> Price per Unit	<b>Column 6</b> Estimated Total Price
		<b>N/A</b>			

5.2 The Unit Price Table that is set out in A5.1 designates the part of the work to which a Unit Price Arrangement is applicable.

5.3 The part of the work that is not designated in the Unit Price Table referred to in A5.2 is the part of the work to which a Fixed Price Arrangement is applicable.

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**Articles of Agreement**

Signed on behalf of Her Majesty by

\_\_\_\_\_

as Senior Contracting Officer

and \_\_\_\_\_

as \_\_\_\_\_

of the **National Research Council Canada**

on the \_\_\_\_\_

day of \_\_\_\_\_

Signed, sealed and delivered by

\_\_\_\_\_

as \_\_\_\_\_ and  
Position

by \_\_\_\_\_

as \_\_\_\_\_ and  
Position

of

on the \_\_\_\_\_

day of \_\_\_\_\_

**Seal**

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APPENDIX A

Geotechnical Report

APPENDIX B

Storm Sewer at Steam Crossing



The following is a list of drawings which accompany these specifications and which form part of the Contract Documents for the Work:

ELECTRICAL

ED01        DEMOLITION  
E01        LEGEND, DRAWING LIST, SCHEDULES, AND DETAILS  
E02        SITE LIGHTING  
E03        POWER – SEWAGE TREATMENT PLANT

CIVIL

C01        EROSION AND SEDIMENT CONTROL  
C02        SITE SERVICING: WATERMAIN  
C03        SITE SERVICING: STORM SEWER  
C04        SITE SERVICING: SANITARY SEWER  
C05        SITE SERVICING: SANITARY SEWER DETAIL  
C06        GRADING  
C07        GENERAL DETAILS AND NOTES  
C08        WATERMAIN DETAILS



**1. SCOPE OF WORK**

- .1 Work under this contract covers the watermain replacement, repairs to storm sewers, parking lot rehabilitation and interception and treatment of the sanitary discharge located at the National Research Council, 100 Sussex Drive, Ottawa, Ontario.

**2. DRAWINGS**

- .1 Refer to Section 00 01 50 – List of Drawings for the drawings forming part of this contract.

**3. COMPLETION**

- .1 All civil works, i.e. pavement, regarding, storm, sanitary underground works, etc. shall be completed prior to November 15, 2016.
- .2 Complete installation and start-up of sewage treatment unit prior to December 31, 2016.

**4. GENERAL**

- .1 The word "provide" in this Specification means to supply and install.
- .2 Provide items mentioned in either the drawings or the specification.

**5. SPECIFIED ACCEPTABLE & ALTERNATIVE EQUIPMENT & MATERIALS**

- .1 Materials and equipment scheduled and/or specified on the drawings or in the specifications have been selected to establish a performance and quality standard. In most cases, acceptable manufacturers are stated for any material or equipment specified by manufacturer's name and model number. Contractors may base their tender price on materials and equipment supplied by any of the manufacturers' names as acceptable for the particular material or equipment.
- .2 In addition to the manufacturers specified or named as acceptable, you may propose alternative manufacturers of materials or equipment to the Departmental Representative for acceptance. For a product to be considered as an alternative product substitute, make a written application to the Departmental Representative during the tender period, not later than ten (10) working days before tender closing.
- .3 Certify in writing that the alternative meets all requirements of the specified material or equipment. In addition, it shall be understood that all costs required by or as a result of acceptance or proposed alternatives, will be borne by the contractor.
- .4 Approval of alternatives will be signified by issue of an Addendum to the Tender Documents.
- .5 Any alternative manufacturers or materials submitted which are incomplete and cannot be evaluated, or are later than ten (10) working days before tender closing date or after the tender period, will not be considered.

**6. MINIMUM STANDARDS**

- .1 Conform to or exceed minimum acceptable standards of the various applicable federal, provincial and municipal codes such as The National Building Code, The National Fire Code, Canadian Plumbing Code, Canadian Electrical Code, Canadian Code for Construction Safety and the Provincial Construction Safety Act.
- .2 Work to conform to referenced standards and codes as reaffirmed or revised to date of specification.

**7. WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS)**

- .1 The general contractor shall comply with Federal and Provincial legislation regarding the WHMIS. The contractor's responsibilities include, but are not limited to the following:
  - .1 To ensure that any controlled product brought on site by the contractor or sub-contractor is labeled;
  - .2 To make available to the workers and the Departmental Representative, Material Safety Data Sheets (MSDS) for these controlled products;
  - .3 To train own workers about WHMIS, and about the controlled products that they use on site; and
  - .4 To inform other contractors, sub-contractors, the Departmental Representative, authorized visitors and outside inspection agency personnel about the presence and use of such products on the site.
  - .5 The site foreman or superintendent must be able to demonstrate, to the satisfaction of the Departmental Representative, that he/she has had WHMIS training and is knowledgeable in its requirements. The Departmental Representative can require replacement of this person if this condition or implementation of WHMIS is not satisfactory.

**8. REQUIREMENTS OF BILL 208, SECTION 18(a)**

- .1 Under the requirements of Bill 208 of the Ontario Ministry of Labour Occupational Health & Safety Act, the following designated substances may be encountered while performing the work described in these contract documents:
  - .1 Acrylonitrile, Isocyanates, Arsenic, Lead, Asbestos, Mercury, Benzene, Silica, Coke Oven Emissions, Vinyl Chloride, and Ethylene Oxide.
    - .1 It is the responsibility of the general contractor to ensure that each prospective subcontractor for this project has received a copy of the above list.
    - .2 In addition to the above designated substances, the following may also be present: mercury.
    - .3 The general contractor is to take the appropriate precautions when dealing with the above substances.

**9. COST BREAKDOWN**

- .1 Submit, for approval by the Departmental Representative, a cost breakdown of tender 72 hours after the contract is awarded.
- .2 Use the approved cost breakdown as the basis for submitting all claims.
- .3 Request Departmental Representative's verbal approval to amount of claim prior to preparing and submitting the claim in its final form.

**10. SUB-TRADES**

- .1 Submit no later than 72 hours after tender closing, a complete list of sub trades for the Departmental Representative's review.

**11. PERSONNEL SECURITY AND IDENTIFICATION**

- .1 All persons employed by the contractor, or by any subcontractor and present on the site must be security cleared in accordance with the requirements of the Section entitled Special Instructions to Tenderers.
- .2 All such persons must wear and keep visible identification badges as issued by the Security Office of NRC.

**12. WORKING HOURS AND SECURITY**

- .1 Normal working hours on the NRC property are from 8:00 a.m. until 4:30 p.m., Monday to Friday inclusive, except statutory holidays.
- .2 At all other times, special written passes are required for access to the building site.
- .3 Before scheduling any work outside normal working hours, obtain permission from the Departmental Representative to perform the specific tasks.
- .4 An escort may be required whenever working outside normal hours. Contractor to bear the associated costs.

**13. SCHEDULE**

- .1 The contractor shall prepare a detailed schedule, fixing the date for commencement and completion of the various parts of the work and update the said schedule. Such schedule shall be made available to the Departmental Representative not later than two (2) weeks after the award of the contract and prior to commencement of any work on site.
- .2 Notify Departmental Representative in writing of any changes in the schedule.
- .3 Five (5) days before the scheduled completion date, arrange to do an interim inspection with the Departmental Representative.

**14. PROJECT MEETINGS**

- .1 Hold regular project meetings at times and locations approved by the Departmental Representative.
- .2 Notify all parties concerned of meetings to ensure proper coordination of work.
- .3 Departmental Representative will set times for project meetings and assume responsibility for recording and distributing minutes.

**15. SHOP DRAWINGS**

- .1 Submit to Departmental Representative for review, shop drawings, product data and samples specified within two (2) weeks after contract award.
- .2 Submit to Departmental Representative for review a complete list of all shop drawings, product data and samples specified and written confirmation of corresponding delivery dates within one (1) week after shop drawings, product data and samples approval date. This list shall be updated on a bi-weekly basis and any changes to the list shall be immediately notified in writing to the Departmental Representative.
- .3 Review shop drawings, data sheets and samples prior to submission.
- .4 Submit electronic copy of all shop drawings and product data and samples for review, unless otherwise specified.
- .5 Review of shop drawings and product data by the Departmental Representative does not relieve the contractor of the responsibility for errors and omissions and for the conformity with contract documents.

**16. SAMPLES AND MOCK-UPS**

- .1 Submit samples in sizes and quantities as specified.
- .2 Where colour, pattern or texture is criterion, submit full range of samples.
- .3 Construct field samples and mock-ups at locations acceptable to Departmental Representative.
- .4 Reviewed samples or mock-ups will become standards of workmanship and material against which installed work will be checked on the project.

**17. MATERIALS AND WORKMANSHIP**

- .1 Install only new materials on this project unless specifically noted otherwise.
- .2 Only first class workmanship will be accepted, not only with regard to safety, efficiency, durability, but also with regard to neatness of detail and performance.

**18. WORK & MATERIALS SUPPLIED BY OWNER**

- .1 Work and materials not included in this contract are described on drawings and in this specification.
- .2 Deliver to a storage place, as directed by the Departmental Representative, all materials returned to the Owner.
- .3 Unless otherwise specified, accept owner-supplied materials at their storage location and provide all transportation as required.
- .4 General Contractor's duties:
  - .1 Unload at site.
  - .2 Promptly inspect products and report damaged or defective items.
  - .3 Give written notification to the Departmental Representative for items accepted in good order.
  - .4 Handle at site, including uncrating and storage.
  - .5 Repair or replace items damaged on site.
  - .6 Install, connect finished products as specified.

**19. SITE ACCESS**

- .1 Make prior arrangements with the Departmental Representative before starting work or moving materials and equipment on site.
- .2 Obtain approval of Departmental Representative for regular means of access during the construction period.
- .3 Obtain approval of Departmental Representative before temporarily suspending operations on site; before returning to the site and before leaving the site at the end of the job.
- .4 Provide and maintain access to site.
- .5 Build and maintain temporary roads and provide snow removal during period of work.
- .6 Make good any damage and clean up dirt, debris, etc., resulting from contractor's use of existing roads.

**20. USE OF SITE**

- .1 Restrict operations on the site to the areas approved by the Departmental Representative.
- .2 Locate all temporary structures, equipment, storage, etc., to the designated areas.
- .3 Restrict parking to the designated areas.

**21. ACCEPTANCE OF SITE**

- .1 Inspect the site before commencing work, review any unexpected conditions with the Departmental Representative.
- .2 Commencement of work will imply acceptance of existing conditions.

**22. SITE OFFICE & TELEPHONE**

- .1 Contractor to erect a temporary site office at his own expense.
- .2 Install and maintain a telephone, if necessary.
- .3 Use of NRC phones is not permitted unless in the case of an emergency.

**23. SANITARY FACILITIES**

- .1 Provide sanitary facilities, and bear all associated costs.

**24. TEMPORARY SERVICES**

- .1 A source of temporary power will be made available in the area. Bear all costs to make connections to the power source and perform distribution on site.
- .2 Provide all load centres, breakers, conduit, wiring, disconnects, extension cords, transformers, as required from the source of power.
- .3 Power is to be used only for power tools, lighting, controls, motors, and not for space heating.
- .4 A source of temporary water will be made available if required.
- .5 Bear all costs associated with distributing the water to the required locations.
- .6 Comply with NRC requirements when connecting to existing systems in accordance with the articles entitled "Co-operation" and "Service Interruptions" of this section.

**25. DOCUMENTS REQUIRED AT WORK SITE**

- .1 The contractor shall keep on the site, one (1) up-to-date copy of all contract documents, including specifications, drawings, addenda, shop drawings, change notices, schedule and any reports or bulletins pertaining to the work, in good order, available to the Departmental Representative and to his / her representatives at all times.
- .2 At least one (1) copy of specifications and drawings shall be marked by the contractor to show all work "As Built" and shall be provided to the Departmental Representative with the Application for Payment and for the Final Certificate of Completion.



**26. CO-OPERATION**

- .1 Co-operate with NRC staff in order to keep disruption of normal research work to an absolute minimum.
- .2 Work out in advance, a schedule for all work which might disrupt normal work in the building.
- .3 Have schedule approved by the Departmental Representative.
- .4 Notify the Departmental Representative in writing, 72 hours prior to any intended interruption of facilities, areas, corridors, mechanical or electrical services and obtain requisite permission.

**27. PROTECTION AND WARNING NOTICES**

- .1 Provide all materials required to protect existing equipment.
- .2 Erect dust barriers to prevent dust and debris from spreading through the building.
- .3 Place dust protection in the form of cover sheets over equipment and furniture and tape these sheets to floors, to ensure no dust infiltration.
- .4 Repair or replace any and all damage to Owner's property caused during construction, at no cost to the Owner and to the satisfaction of the Departmental Representative.
- .5 Protect the buildings, roads, lawns, services, etc. from damage which might occur as a result of this work.
- .6 Plan and co-ordinate the work to protect the buildings from the leakage of water, dust, etc.
- .7 Ensure that all doors, windows, etc., that could allow transfer of dust, noise, fumes, etc., to other areas of the building are kept closed.
- .8 Be responsible for security of all areas affected by the work under the Contract until acceptance by NRC. Take all necessary precautions to prevent entry to the work area by unauthorized persons and guard against theft, fire and damage by any cause. Secure working area at the end of each day's work and be responsible for same.
- .9 Provide and maintain adequate safety barricades around the work sites to protect NRC personnel and the public from injury during the construction.
- .10 Post warnings, in all instances where possible injury could occur such as Work Overhead, Hard Hat Areas, etc. or as required by the Departmental Representative.
- .11 Provide temporary protective enclosures over building entrances and exits to protect pedestrians. All enclosures to be structurally sound against weather and falling debris.
- .12 All work to be completed in accordance with City of Ottawa Noise By-Law 2004-253.

**28. BILINGUALISM**

- .1 Ensure that all signs, notices, etc. are posted in both official languages.
- .2 Ensure that all identification of services called for by under this contract are bilingual.

**29. LAYOUT OF WORK**

- .1 Location of equipment, fixtures, outlets and openings indicated on drawings or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with the manufacturer's recommendations for safety, access and maintenance.
- .3 Employ competent person to lay out work in accordance with the contract documents.

**30. DISCREPANCIES & INTERFERENCES**

- .1 Prior to the start of the work, examine drawings and specifications. Report at once to the Departmental Representative, any defects, discrepancies, omissions or interferences affecting the work.
- .2 Contractor to immediately inform the Departmental Representative in writing, of any discrepancies between the plans and the physical conditions so the Departmental Representative may promptly verify same.
- .3 Any work done after such a discovery, until authorized, is at the contractor's risk.
- .4 Where minor interferences as determined by the Departmental Representative are encountered on the job and they have not been pointed out on the original tender or on the plans and specifications, provide offsets, bends or reroute the services to suit job conditions at no extra cost.
- .5 Arrange all work so as not to interfere in any way with other work being carried out.

**31. MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 Notify the Departmental Representative in writing of any conflict between these specifications and manufacturer's instruction. Departmental Representative will designate which document is to be followed.

**32. TEMPORARY HEATING AND VENTILATING**

- .1 Bear the costs of temporary heat and ventilation during construction including costs of installation, fuel, operation, maintenance, and removal of equipment.

- .2 Use of direct-fired heaters discharging waste products into the work areas will not be permitted unless prior approval is given by the Departmental Representative.
- .3 Furnish and install temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of work.
  - .2 Protect work and products against dampness and cold.
  - .3 Reduce moisture condensation on surfaces to an acceptable level.
  - .4 Provide ambient temperature and humidity levels for storage, installation and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for a safe working environment.
- .4 Maintain minimum temperature of 10 °C (50 °F) or higher where specified as soon as finishing work is commenced and maintain until acceptance by the Departmental Representative.
  - .1 Maintain ambient temperature and humidity levels as required for comfort of NRC personnel.
- .5 Prevent hazardous or unhealthy accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction including also, storage areas and sanitary facilities.
  - .1 Dispose of exhaust materials in a manner that will not result in a harmful or unhealthy exposure to persons.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment.
  - .1 Enforce conformance with applicable codes and standards.
  - .2 Comply with instructions of the Departmental Representative including provision of full-time watchman services when directed.
  - .3 Enforce safe practices.
  - .4 Vent direct-fired combustion units to outside.
- .7 Submit tenders assuming existing or new equipment and systems will not be used for temporary heating and ventilating.
- .8 After award of contract, Departmental Representative may permit use of the permanent system providing agreement can be reached on:
  - .1 Conditions of use, special equipment, protection, maintenance, and replacement of filters.
  - .2 Methods of ensuring that heating medium will not be wasted and in the case of steam, agreement on what is to be done with the condensate.
  - .3 Saving on contract price.
  - .4 Provisions relating to guarantees on equipment.

### **33. CONNECTIONS TO AND INTERRUPTIONS TO EXISTING SERVICES**

- .1 Where work involves breaking into or connecting to existing services, carry out work at times and in the manner agreed to by the Departmental Representative and by authorities

having jurisdiction, with minimum disruption to NRC Personnel and vehicular traffic and minimum service interruption. Do not operate any NRC equipment or plant.

- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit a schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility; allow minimum 72 hours notice. Adhere to approved schedule and provide notice to the Departmental Representative.
- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Provide detours, bridges, alternate feeds, etc., as required to minimize disruptions.
- .6 Protect existing services as required and immediately make repairs if damage occurs.
- .7 Remove any abandoned service lines as indicated on the contract documents and as approved by the Departmental Representative; cap or otherwise seal lines at cut-off points. Record and provide a copy to the Departmental Representative of locations of maintained, re-routed and abandoned service lines.

#### **34. CUTTING AND PATCHING**

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove all items as shown or specified.
- .3 Patch and make good with identical materials, the surfaces that have been disturbed, cut or damaged, to the satisfaction of the Departmental Representative.
- .4 Where new pipes pass through existing construction, core drill an opening. Size openings to leave 12mm (1/2") clearance around the pipes or pipe insulation. Do not drill or cut any surface without the approval of the Departmental Representative.
- .5 Obtain written approval of the Departmental Representative before cutting openings through existing or new structural members.
- .6 Seal all openings where cables, conduits or pipes pass through walls with an acoustic sealant conforming to CAN/CGSB-19.21-M87.
- .7 Where cables, conduits and pipes pass through fire rated walls and floors, pack space between with compressed glass fibres and seal with fire stop caulking in accordance with CAN/CGSB-19.13-M87 AND NBC 3.1.7.

#### **35. FASTENING DEVICES**

- .1 Do not use explosive actuated tools, without first obtaining permission from the Departmental Representative.

- .2 Comply with the requirements of CSA A-166 (Safety Code for Explosive Actuated Tools).
- .3 Do not use any kind of impact or percussion tool without first obtaining permission from the Departmental Representative.

**36. OVERLOADING**

- .1 Ensure that no part of the building or work is subjected to a load which will endanger safety or cause permanent deformation or structural damage.

**37. DRAINAGE**

- .1 Provide temporary drainage and pumping as required to keep excavations and site free of water.

**38. ENCLOSURE OF STRUCTURES**

- .1 Construct and maintain all temporary enclosures as required to protect foundations, sub-soil, concrete, masonry, etc., from frost penetration or damage.
- .2 Maintain in place until all chances of damage are over and proper curing has taken place.
- .3 Provide temporary weather tight enclosures for exterior openings until permanent sash and glazing and exterior doors are installed.
- .4 Provide lockable enclosures as required to maintain the security of NRC facilities and be responsible for the same.
- .5 Provide keys to NRC security personnel when required.
- .6 Lay out the work carefully and accurately and verify all dimensions and be responsible for them. Locate and preserve general reference points.
- .7 Throughout the course of construction, keep continuously acquainted with field conditions, and the work being developed by all trades involved in the project. Maintain an awareness of responsibility to avoid space conflict with other trades.
- .8 Conceal all services, piping, wiring, ductwork, etc., in floors, walls or ceilings except where indicated otherwise.

**39. STORAGE**

- .1 Provide storage as required to protect all tools, materials, etc., from damage or theft and be responsible for the same.
- .2 Do not store flammable or explosive materials on site without the authorization of the Departmental Representative.

**40. GENERAL REVIEW**

- .1 Periodic review of the contractor's work by the Departmental Representative does not relieve the contractor of the responsibility of making the work in accordance with contract documents. Contractor shall carry out his own quality control to ensure that the construction work is in accordance with contract documents.
- .2 Inform the Departmental Representative of any impediments to the installation and obtain his / her approval for actual location.

**41. INSPECTION OF BURIED OR CONCEALED SERVICES**

- .1 Prior to concealing any services that are installed, ensure that all inspection bodies concerned, including NRC, have inspected the work and have witnessed all tests. Failure to do so may result in exposing the services again at the contractor's expense.

**42. TESTING**

- .1 On completion, or as required by local authority inspectors and/or Departmental Representative during progress of work and before any services are covered up and flushing is complete, test all installations in the presence of the Departmental Representative.
- .2 Obtain and hand to the Departmental Representative all acceptance certificates or test reports from authority having jurisdiction. The project will be considered incomplete without the same.

**43. PARTIAL OCCUPANCY**

- .1 NRC may request partial occupancy of the facility if the contract extends beyond the expected completion date.
- .2 Do not restrict access to the building, routes, and services.
- .3 Do not encumber the site with materials or equipment.

**44. DISPOSAL OF WASTES**

- .1 Dispose of waste materials including volatiles, safely off NRC property. Refer to the section entitled "General and Fire Safety Requirements" included as part of this specification.

**45. CLEAN-UP DURING CONSTRUCTION**

- .1 On a daily basis, maintain project site and adjacent area of campus including roofs, free from debris and waste materials.
- .2 Provide on-site dump containers for collection of waste materials and rubbish.

**46. FINAL CLEAN-UP**

- .1 Upon completion do a final clean-up to the satisfaction of the Departmental Representative.
- .2 Clean all new surfaces, lights, existing surfaces affected by this work, replace filters, etc.
- .3 Clean all resilient flooring and prepare to receive protective finish. Protective finish applied by NRC.

**47. WARRANTY AND RECTIFICATION OF DEFECTS IN WORK**

- .1 Refer to General Conditions "C", section GC32.
- .2 Ensure that all manufacturers' guarantees and warranties are issued in the name of the **General Contractor** and the National Research Council.

**48. MAINTENANCE MANUALS**

- .1 Provide three (3) bilingual copies of maintenance manuals or two (2) English and two (2) French maintenance manuals immediately upon completion of the work and prior to release of holdbacks.
- .2 Manuals to be neatly bound in hard cover loose leaf binders.
- .3 Manuals to include operating and maintenance instructions, all guarantees and warranties, shop drawings, technical data, etc., for the material and apparatus supplied under this contract.

**END OF SECTION**





**1. GENERAL CONSTRUCTION SAFETY REQUIREMENTS**

- .1 The Contractor shall take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property from any harm during the course of the contract.
- .2 The Contractor shall be solely responsible for the construction safety of both its employees and those of its sub-contractors at the work site, and for initiating, maintaining and supervising safety precautions, programs and procedures in connection with the performance of the work.
- .3 The Contractor shall comply with all Federal, Provincial and Municipal safety codes and regulations and the Occupational Health and Safety Act and the Workplace Safety and Insurance Board. In the event of any conflict between any provisions in legislation or codes, the most stringent provisions shall apply.
- .4 Periodic review of the contractor's work by the Departmental Representative, using the criteria of the contract documents, does not relieve the contractor of his safety responsibilities in carrying out the work in accordance with the contract documents. The contractor shall consult with the Departmental Representative to ensure that this responsibility is carried out.
- .5 The Contractor shall ensure that only competent personnel are permitted to work on site. Throughout the term of the contract, any person will be removed from the site who is not observing or complying with the safety requirements.
- .6 All equipment shall be in safe operating condition and appropriate to the task.
- .7 Following a project and site hazard assessment, the Contractor shall develop a Site Specific Safety Plan based on the following minimum requirements:
  - .1 Provide a safety board mounted in a visible location on the project site, with the following information included thereon:
    - .1 Notice of Project.
    - .2 Site specific Safety Policy.
    - .3 Copy of Ontario Health and Safety Act.
    - .4 Building Schematic showing emergency exits.
    - .5 Building emergency procedures.
    - .6 Contact list for NRC, Contractor and all involved sub-contractors.
    - .7 Any related MSDS sheets.
    - .8 NRC Emergency phone number.
  - .8 The Contractor shall provide competent personnel to implement its safety program and those of any Health and Safety Act legislation applicable at this project location, and to ensure they are being complied with.
  - .9 The Contractor shall provide safety orientation to all its employees as well as those of any subcontractors under its jurisdiction.

- .10 The Departmental Representative will monitor to ensure that safety requirements are met and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the contract to be cancelled and the Contractor or sub-contractors removed from the site.
- .11 The Contractor will report to the Departmental Representative and jurisdictional authorities, any accident or incident involving Contractor or NRC personnel or the public and/or property arising from the Contractor's execution of the work.
- .12 If entry to a laboratory is required as part of the work of the Contractor, a safety orientation shall be provided to all his employees as well as those of any subcontractors regarding lab safety requirements and procedures, as provided by the Researcher or the Departmental Representative.

## **2. FIRE SAFETY REQUIREMENTS**

### **.1 Authorities**

1. The Fire Commissioner of Canada (FC) is the authority for fire safety at NRC.
2. For the purpose of this document, "Departmental Representative" will be deemed as the NRC person in charge of the project and who will enforce these Fire Safety Requirements.
3. Comply with the following standards as published by the Office of the Fire Commissioner of Canada:
  - .1 Standard No. 301 - June 1982 "Standard for Construction Operations"; and
  - .2 Standard No. 302 - June 1982 "Standard for Welding and Cutting".

### **.2 Smoking**

1. Smoking is prohibited inside all NRC buildings, as well as roof areas.
2. Obey all "NO SMOKING" signs on NRC premises.

### **.3 Hot Work**

1. Prior to commencement of any "Hot Work" involving welding, soldering, burning, heating, use of torches or salamanders or any open flame, obtain a Hot Work Permit from the Departmental Representative.
2. Prior to commencement of "Hot Work", review the area of hot work with the Departmental Representative to determine the level of fire safety precautions to be taken.

### **.4 Reporting Fires**

1. Know the exact location of the nearest Fire Alarm Pull Station and telephone, including the emergency phone number.
2. REPORT immediately, all fire incidents as follows:
  - .1 Activate nearest fire alarm pull station; and

.2 Telephone the following emergency phone number as appropriate:

<b>FROM AN NRC PHONE</b>	<b>333</b>
<b>FROM ANY OTHER PHONE</b>	<b>(613) 993-2411</b>

3. When reporting a fire by phone, give the location of fire, building number and be prepared to verify location.
4. The person activating fire alarm pull station must remain at a safe distance from the scene of the fire but readily available to provide information and direction to the Fire Department personnel.

#### **.5 Interior and Exterior Fire protection & Alarm Systems**

1. Do not obstruct or shut off fire protection equipment or systems, including but not limited to fire alarm systems, smoke/heat detectors, sprinkler system, pull stations, emergency call buttons and PA systems, without authorization from the Departmental Representative.
2. When any fire protection equipment is temporarily shut down, alternative measures as prescribed by the Departmental Representative shall be taken to ensure that fire protection is maintained.
3. Do not leave fire protection or alarm systems inactive at the end of a working day without notification and authorisation from the Departmental Representative. The Departmental Representative will advise the (FPO) of the details of any such event.
4. Do not use fire hydrants, standpipes and hose systems for other than firefighting purposes unless authorised by Departmental Representative.

#### **.6 Fire Extinguishers**

1. Provide a minimum of 1-20 lb. ABC Dry Chemical Fire Extinguisher at each hot work or open flame location.
2. Provide fire extinguishers for hot asphalt and roofing operations as follows:
  - .1 Kettle area - 1-20 lb. ABC Dry Chemical; and
  - .2 Roof - 1-20 lb. ABC Dry Chemical at each open flame location.
3. Provide fire extinguishers equipped as below:
  - .1 Pinned and sealed;
  - .2 With a pressure gauge; and
  - .3 With an extinguisher tag signed by a fire extinguisher servicing company.
4. Carbon Dioxide (CO<sub>2</sub>) extinguishers will not be considered as substitutes for the above.

#### **.7 Roofing Operations**

1. Kettles:

- .1 Arrange for the location of asphalt kettles and material storage with the Departmental Representative before moving on site. Do not locate kettles on any roof or structure and keep them at least 10m (30 feet) away from a building.
  - .2 Equip kettles with 2 thermometers or gauges in good working order; a hand held and a kettle-mounted model.
  - .3 Do not operate kettles at temperatures in excess of 232°C (450 °F).
  - .4 Maintain continuous supervision while kettles are in operation and provide metal covers for the kettles to smother any flames in case of fire. Provide fire extinguishers as required in article 2.6.
  - .5 Demonstrate container capacities to Departmental Representative prior to start of work.
  - .6 Store materials a minimum of 6m (20 feet) from the kettle.
  2. Mops:
    - .1 Use only glass fibre roofing mops.
    - .2 Remove used mops from the roof site at the end of each working day.
  3. Torch Applied Systems:
    - .1 Do not use torches next to walls.
    - .2 Do not torch membranes to exposed wood or cavity.
    - .3 Provide a Fire Watch as required by article 2.9 of this section.
  4. Store all combustible roofing materials at least 3m (10 feet) away from any structure.
  5. Keep compressed gas cylinders a minimum of 6m (20 feet) away from the kettle, protected from mechanical damage, and secured in an upright position.
- .8 Welding / Grinding Operations**
1. Contractor to provide fire blankets, portable fume extraction devices, screens or similar equipment to prevent exposure to welding flash, or sparks from grinding.
- .9 Fire Watch**
1. Provide a fire watch for a minimum of one (1) hour after the termination of any hot work operation.
  2. For temporary heating, refer to General Instructions Section 00 10 00.
  3. Equip fire watch personnel with fire extinguishers as required by article 2.6.
- .10 Obstruction of access/egress routes-roadways, halls, doors, or elevators**
1. Advise the Departmental Representative in advance of any work that would impede the response of Fire Department personnel and their apparatus. This includes violation of minimum overhead clearance, erection of barricades and the digging of trenches.
  2. Building exit routes must not be obstructed in any way without special permission from the Departmental Representative, who will ensure that adequate alternative routes are maintained.

3. The Departmental Representative will advise the FPO of any obstruction that may warrant advanced planning and communication to ensure the safety of building occupants and the effectiveness of the Fire Department.

#### **.11 Rubbish and Waste Materials**

1. Keep rubbish and waste materials to a minimum and a minimum distance of 6m (20 feet) from any kettle or torches.
2. Do not burn rubbish on site.
3. Rubbish Containers:
  - .1 Consult with the Departmental Representative to determine an acceptable safe location for any containers and the arrangement of chutes, etc. prior to bringing the containers on site.
  - .2 Do not overfill the containers and keep area around the perimeter free and clear of any debris.
4. Storage:
  - .1 Exercise extreme care when storing combustible waste materials in work areas. Ensure maximum possible cleanliness, ventilation and that all safety standards are adhered to when storing any combustible materials.
  - .2 Deposit greasy or oily rags or materials subject to spontaneous combustion in CSA or ULC approved receptacles and remove at the end of the work day or shift, or as directed.

#### **.12 Flammable Liquids**

1. The handling, storage and use of flammable liquids is governed by the current National Fire Code of Canada.
2. Flammable Liquids such as gasoline, kerosene and naphtha may be kept for ready use in quantities not exceeding 45 litres (10 imp gal), provided they are stored in approved safety cans bearing the ULC seal of approval and kept away from buildings, stockpiled combustible materials, etc. Storage of quantities of flammable liquids exceeding 45 litres (10 imp gal) for work purposes, require the permission of the Departmental Representative.
3. Flammable liquids are not to be left on any roof areas after normal working hours.
4. Transfer of flammable liquids is prohibited within buildings.
5. Do not transfer flammable liquids in the vicinity of open flames or any type of heat producing device.
6. Do not use flammable liquids having a flash point below 38 °C (100 °F) such as naphtha or gasoline as solvents or cleaning agents.
7. Store flammable waste liquids for disposal in approved container located in a safe, ventilated area. Waste flammable liquids are to be removed from the site on a regular basis.
8. Where flammable liquids, such as lacquers or urethane are used, ensure proper ventilation and eliminate all sources of ignition. Inform the Departmental Representative prior to, and at the cessation of such work.

**.13 Questions and/or clarifications**

1. Direct any questions or clarification on Fire or General Safety, in addition to the above requirements, to the Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1      Ontario Provincial Standard Specifications (OPSS).
- .2      Ontario Provincial Standard Drawings (OPSD).

**1.2                WORK COVERED BY CONTRACT DOCUMENTS**

- .1      Work of this Contract comprises of the rehabilitation of the watermains, the parking lot and service roads, the storm sewers and the exterior lighting for National Research Council of Canada (NRC) campus located at 100 Sussex Drive at the intersection with King Edward Avenue in Ottawa, Ontario. The site is located on the north side of the Sussex Drive, bound by the Rideau River to the east, the Ottawa River to the north and the British High Commissioner property to the west. Work includes the following:
  - .1      Asphalt Removal.
  - .2      Storm Sewers.
  - .3      Maintenance Holes and Catch Basins.
  - .4      Pre-manufacturer FRP Pump Station.
  - .5      Sewage Treatment Plant.
  - .6      Electrical Conduit.
  - .7      Excavation, Grading and Paving.
  - .8      Concrete Curbs and Sidewalks.
  - .9      Site Lighting.
  - .10     Landscaping.
  - .11     Other Related Work.

**1.3                CONTRACT METHOD**

- .1      Construct Work under lump sum price contract.
- .2      Relations and responsibilities between Contractor and Subcontractors assigned by Owner are as defined in Conditions of Contract. Assigned Subcontractors must, in addition:
  - .1      Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations thereunder when Contractor is required to furnish such bonds to Departmental Representative.
  - .2      Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Departmental Representative.

**1.4                WORK BY OTHERS**

- .1      Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.

- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

## **1.5 WORK SEQUENCE**

- .1 Construct Work in stages to accommodate Owner's use of premises during construction.
  - .1 The Contractor will be required to submit a construction staging plan for approval to the Departmental Representative prior to the commencement of work for approval.
  - .2 Staging plan to accommodate and include the following provisions:
    - .1 Day time access to loading docks must remain active.
    - .2 Maintain Fire route access through site.
    - .3 Maintain a minimum of 230 parking spots during all phases of construction during regular business hours.
    - .4 Contractor to provide all necessary signage and barricades to identify closures and detours.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.
- .3 Construct Work in stages to provide for continuous public usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.
- .4 Task such as milling entire parking lot, grading, installation of underground services may be completed by closing off site after business hours and on weekends with approval of the Departmental Representative.
- .5 Maintain O.C. Transpo access (Route 9) along Sussex Drive and pedestrian access to all bus stops within the construction limits at all times. Provide O.C. Transpo at least three (3) working days' notice to coordinate any adjustments required to their facilities as a result of construction.

## **1.6 CONTRACTOR USE OF PREMISES**

- .1 Limit use of premises for Work, storage, and for access to allow:
  - .1 Owner occupancy.
  - .2 Work by other contractors.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Contractor and his sub-contractors are limited to a total 6 parking spaces on site for the duration of the construction.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.



- .5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .7 At completion of operations condition of existing work: equal to or better than that which existed before new work started.
- .8 Contractor will be responsible for snow removal of the entire construction area for the duration of the construction period.

**1.7 OWNER OCCUPANCY**

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

**1.8 EXISTING SERVICES**

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hour notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to vehicular traffic and tenant operations.
- .3 Provide alternative routes for personnel and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by Departmental Representative to maintain critical building and tenant systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.

**1.9 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one (1) copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.
  - .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Geotechnical Report by Houle Chevrier Engineering Ltd. dated November 2013, Ref. No. 13-337.
  - .12 Other documents as specified.

**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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE**

- .1 No measurement for payment will be made under this section. Include costs in items where required.

**1.2 APPOINTMENT AND PAYMENT**

- .1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
  - .4 Mill tests and certificates of compliance.
  - .5 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.
  - .6 Additional tests specified as follows:
    - .1 Granular Gradation.
    - .2 Granular Compaction – Road Base and Sub-Base.
    - .3 Granular Compaction – Utility Trench.
    - .4 Asphalt Compaction, Voids, Gradation and AC Content.
    - .5 Concrete Strength.
    - .6 Concrete Air and Slump.
    - .7 Topsoil.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

**1.3 CONTRACTOR'S RESPONSIBILITIES**

- .1 Provide labour, equipment and facilities to:
  - .1 Provide access to Work for inspection and testing.
  - .2 Facilitate inspections and tests.
  - .3 Make good Work disturbed by inspection and test.
  - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative 48 hours (minimum) in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

**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                ADMINISTRATIVE**

- .1     Schedule and administer project meetings throughout the progress of the work at the call of the Departmental Representative.
- .2     Prepare agenda for meetings.
- .3     Distribute written notice of each meeting four (4) days in advance of meeting date to Departmental Representative.
- .4     Provide physical space and make arrangements for meetings.
- .5     Preside at meetings.
- .6     Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7     Reproduce and distribute copies of minutes within five (5) days after meetings and transmit to meeting participants, affected parties not in attendance and Departmental Representative.
- .8     Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

**1.2                PRECONSTRUCTION MEETING**

- .1     Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2     Owner, Departmental Representative, Contractor, Major Subcontractors, field inspectors and supervisors will be in attendance.
- .3     Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4     Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5     Agenda to include:
  - .1     Appointment of official representative of participants in the Work.
  - .2     Schedule of Work.
  - .3     Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4     Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

- .5 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .6 Owner provided products.
- .7 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .8 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .9 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Monthly progress claims, administrative procedures, photographs, hold backs.
- .11 Appointment of inspection and testing agencies or firms.
- .12 Insurances, transcript of policies.

### **1.3 PROGRESS MEETINGS**

- .1 During course of Work and one (1) week prior to project completion, schedule progress meetings once a week, unless otherwise agreed upon with the Departmental Representative, Owner and Contractor.
- .2 Contractor, major Subcontractors involved in Work, Departmental Representative and Owner are to be in attendance.
- .3 Notify parties minimum five (5) days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within five (5) days after meeting.
- .5 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .9 Review submittal schedules: expedite as required.
  - .10 Maintenance of quality standards.
  - .11 Review proposed changes for effect on construction schedule and on completion date.
  - .12 Other business.

**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                ADMINISTRATIVE**

- .1        Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2        Do not proceed with Work affected by submittal until review is complete.
- .3        Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4        Where items or information is not produced in SI Metric units converted values are acceptable.
- .5        Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6        Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7        Verify field measurements and affected adjacent Work are co-ordinated.
- .8        Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9        Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10      Keep one (1) reviewed copy of each submission on site.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1        The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2        Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .3        Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which

adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .4 Allow five (5) days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .8 Submissions 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, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of 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 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.

- .10 Submit three (3) prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit three (3) copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit three (3) copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been within three (3) years of date of contract award for project.
- .13 Submit three (3) copies of certificates for requirements requested in specification sections and as requested by Departmental Representative.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit three (3) copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit three (3) copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit three (3) copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

- .20 Notwithstanding the above, digital versions of all required submissions (i.e. .pdf format) shall be acceptable and is the preferred method of submittals for this project. Digital versions shall contain all the same information as the hard copies described above.

### **1.3 SAMPLES**

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

### **1.4 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic (.jpg format) and two (2) hard copies of color digital photographs in standard resolution of the pre-existing site conditions to the Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.

### **1.5 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

## **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 RELATED SECTIONS**

- .1 Section 01 33 00 – Submittal Procedures.

**1.2 REFERENCES**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Ontario
  - .1 Occupational Health and Safety Act, R.S.O. 1990.

**1.3 SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  - .1 Results of site specific safety hazard assessment.
  - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within five (5) days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of

Work, and submit additional certifications for any new site personnel to Departmental Representative.

- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

#### **1.4 FILING OF NOTICE**

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

#### **1.5 SAFETY ASSESSMENT**

- .1 Perform site specific safety hazard assessment related to project.

#### **1.6 MEETINGS**

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

#### **1.7 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 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

#### **1.8 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.

#### **1.9 COMPLIANCE REQUIREMENTS**

- .1 Comply with Ontario Health and Safety Act, R.S.O.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

#### **1.10 UNFORSEEN HAZARDS**

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.



**1.11 HEALTH AND SAFETY CO-ORDINATOR**

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have working knowledge of occupational safety and health regulations.
  - .2 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.
  - .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
  - .4 Be on site during execution of Work and report directly to and be under direction of site supervisor.

**1.12 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 Departmental Representative.

**1.13 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

**1.14 BLASTING**

- .1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.
- .2 Do blasting operations in accordance with Section 31 23 16.26 - Rock Removal.

**1.15 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.

**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 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.

**1.2 FIRES**

- .1 Fires and burning of rubbish on site not permitted.

**1.3 DRAINAGE**

- .1 Provide Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls provided. Ensure plan includes monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sedimentations control plan.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

**1.4 SITE CLEARING AND PLANT PROTECTION**

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Departmental Representative.

## **1.5 POLLUTION CONTROL**

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads and temporary granular parking lots.

## **1.6 NOTIFICATION**

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 CLEANING**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
- .2 Waste Management: separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

**END OF SECTION**

**Part 1            General**

**1.1                INSPECTION**

- .1      Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2      Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3      If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4      Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, Contractor is to correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents there will be no compensation to the Contractor.

**1.2                INDEPENDENT INSPECTION AGENCIES**

- .1      Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Contractor.
- .2      Provide equipment required for executing inspection and testing by appointed agencies.
- .3      Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4      If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative or Owner. Pay costs for retesting and re-inspection.

**1.3                ACCESS TO WORK**

- .1      Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2      Co-operate to provide reasonable facilities for such access.

**1.4                PROCEDURES**

- .1      Notify appropriate agency Departmental Representative 48 hours in advance of requirement for tests, in order that attendance arrangements can be made.

- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

## **1.5 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

## **1.6 REPORTS**

- .1 Submit three (3) copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested.

## **1.7 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

## **1.8 EQUIPMENT AND SYSTEMS**

- .1 Submit adjustment and balancing reports for mechanical, electrical systems.

## **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                MEASUREMENT FOR PAYMENT**

- .1        No measurement for payment will be made for this section.

**1.2                INSTALLATION AND REMOVAL**

- .1        Provide temporary utilities controls in order to execute work expeditiously.
- .2        Remove from site all such work after use.

**1.3                DEWATERING**

- .1        Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

**1.4                TEMPORARY POWER AND LIGHT**

- .1        Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps.
- .2        Arrange for connection with appropriate utility company. Pay costs for installation, maintenance, and removal.

**1.5                TEMPORARY COMMUNICATION FACILITIES**

- .1        Provide and pay for temporary telephone, fax, data hook up, equipment necessary for own use and use of Departmental Representative.

**1.6                FIRE PROTECTION**

- .1        Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
- .2        Burning rubbish and construction waste materials is not permitted on site.

**Part 2            Products**

**2.1                NOT USED**

- .1        Not Used.

**Part 3 Execution**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    Canadian General Standards Board (CGSB)
  - .1    CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
  - .2    CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2    Canadian Standards Association (CSA International)
  - .1    CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2    CSA-0121-M1978 (R2003), Douglas Fir Plywood.
  - .3    CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.
  - .4    CAN/CSA-Z321-96 (R2001), Signs and Symbols for the Occupational Environment.

**1.2                INSTALLATION AND REMOVAL**

- .1    Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2    Identify areas which have to be gravelled to prevent tracking of mud.
- .3    Indicate use of supplemental or other staging area.
- .4    Provide construction facilities in order to execute work expeditiously.
- .5    Remove from site all such work after use.

**1.3                SITE STORAGE/LOADING**

- .1    Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2    Do not load or permit to load any part of Work with weight or force that will endanger Work.

**1.4                CONSTRUCTION PARKING**

- .1    Parking will be permitted on site provided it does not disrupt performance of Work.
- .2    Provide and maintain adequate access to project site.
- .3    Clean taxi areas where used by Contractor's equipment.

**1.5 OFFICES**

- .1 Provide office heated to 22 °C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
- .4 Provide private washroom facilities for Departmental Representative adjacent to office complete with flush or chemical type toilet, lavatory and mirror and maintain supply of paper towels and toilet tissue.
- .5 Maintain in clean condition.

**1.6 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

**1.7 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

**1.8 CONSTRUCTION SIGNAGE**

- .1 Provide and erect project sign, within three (3) weeks of signing Contract, in a location designated by Departmental Representative.
- .2 Construction sign of wood frame and plywood construction painted with exhibit lettering.
- .3 No other signs or advertisements, other than warning signs, are permitted on site.
- .4 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .5 Maintain approved signs and notices in good condition for duration of project, and dispose of offsite on completion of project or earlier if directed by Departmental Representative.

**1.9 PROTECTION AND MAINTENANCE OF TRAFFIC**

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.

- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary at the approval of the Departmental Representative.
- .8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Provide dust control as required to ensure safe operation at all times.
- .11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.
- .12 Ensure full and clear visibility for full width of haul road and work areas during night work operations (if required).
- .13 Provide snow removal during period of Work.
- .14 Remove, upon completion of work, haul roads designated by Departmental Representative.

**1.10 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways on a regular basis as directed by the Departmental Representative.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

**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            Owner's identification of existing survey control points and property limits.

**1.2                MEASUREMENT FOR PAYMENT**

- .1            No measurement for payment will be made under this section. Include costs in items where required.

**1.3                QUALIFICATIONS OF SURVEYOR**

- .1            Qualified registered land surveyor (or approved equivalent), licensed to practice in Place of Work, acceptable to Departmental Representative.

**1.4                SURVEY REFERENCE POINTS**

- .1            Existing base horizontal and vertical control points are designated on drawings.
- .2            Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3            Make no changes or relocations without prior written notice to Departmental Representative.
- .4            Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5            Require surveyor to replace control points in accordance with original survey control.

**1.5                SURVEY REQUIREMENTS**

- .1            Establish two (2) permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data, in Project Record Documents.
- .2            Establish lines and levels, locate and lay out, by instrumentation.
- .3            Stake for grading, fill and topsoil placement.
- .4            Stake slopes.
- .5            Establish pipe invert elevations.
- .6            Establish lines and levels for mechanical and electrical work.

**1.6 EXISTING SERVICES**

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

**1.7 LOCATION OF EQUIPMENT AND FIXTURES**

- .1 Location of equipment, fixtures and outlets indicated or specified are to 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 Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

**1.8 RECORDS**

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

**1.9 SUBMITTALS**

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying those elevations and locations of completed Work that conform and do not conform to Contract Documents.

**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                MEASUREMENT FOR PAYMENT**

- .1        No measurement for payment will be made under this section. Include costs in items where required.

**1.2                PROJECT CLEANLINESS**

- .1        Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2        Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative.
- .3        Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4        Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5        Dispose of waste materials and debris off site.
- .6        Store volatile waste in covered metal containers, and remove from premises at end of each working day.

**1.3                FINAL CLEANING**

- .1        When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2        Prior to final review remove surplus products, tools, construction machinery and equipment.
- .3        Remove waste products and debris including that caused by Owner or other Contractors.
- .4        Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative.
- .5        Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6        Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures.
- .7        Clean lighting reflectors, lenses, and other lighting surfaces.
- .8        Sweep and wash clean paved areas.

- .9 Remove snow and ice from access to building.

**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      MEASUREMENT FOR PAYMENT**

- .1      No measurement for payment will be made under this section. Include costs in items where required.

**1.2      WASTE MANAGEMENT GOALS**

- .1      Accomplish maximum control of solid construction waste.
- .2      Preserve environment and prevent pollution and environment damage.

**1.3      DEFINITIONS**

- .1      Class III: non-hazardous waste - construction renovation and demolition waste.
- .2      Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.
- .3      Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .4      Inert Fill: inert waste - exclusively asphalt and concrete.
- .5      Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .6      Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .7      Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .8      Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .9      Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
  - .1      Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
  - .2      Returning reusable items including pallets or unused products to vendors.
- .10      Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

- .11 Separate Condition: refers to waste sorted into individual types.
- .12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
- .14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA.

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal do not become Contractor's property unless approved by the Departmental Representative.
- .3 Protect, stockpile and store salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect surface drainage, mechanical and electrical from damage and blockage.
- .6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
  - .1 On-site source separation is recommended.
  - .2 Remove co-mingled materials to off-site processing facility for separation.

#### **1.5 DISPOSAL OF WASTES**

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.
- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

- .4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

## **1.6 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises.

## **1.7 SCHEDULING**

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 APPLICATION**

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

### **3.2 CLEANING**

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

**END OF SECTION**





**Part 1            General**

**1.1                REFERENCES**

- .1    Canadian Environmental Protection Act (CEPA):
  - .1        SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

**1.2                MEASUREMENT FOR PAYMENT**

- .1    No measurement for payment will be made under this section. Include costs in items where required.

**1.3                ACCEPTANCE OF WORK PROCEDURES**

- .1    Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1        Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and submit verification that corrections have been made.
  - .2        Request Departmental Representative's Inspection.
- .2    Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify defects and deficiencies. Contractor to correct Work as directed.
- .3    Completion Tasks: submit written certificates in English that tasks have been performed as follows:
  - .1        Work: completed and inspected for compliance with Contract Documents.
  - .2        Defects: corrected and deficiencies completed.
  - .3        Equipment and systems: tested and fully operational.
  - .4        Certificates required by Electrical Safety Authority: submitted.
- .4    Final Inspection: when Completion tasks are done, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.
- .5    Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for certificate of Substantial Performance.
- .6    Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

- .7 Final Payment: when Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
- .8 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with contractual agreement.

**1.4 FINAL CLEANING**

- .1 In accordance with Section 01 74 11 - Cleaning.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**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                MEASUREMENT FOR PAYMENT**

- .1        No measurement for payment will be made under this section. Include costs in items where required.

**1.2                ADMINISTRATIVE REQUIREMENTS**

- .1        Pre-Warranty Meeting:
  - .1        Convene meeting one (1) week prior to contract completion with contractor's representative and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:
    - .1        Verify Project requirements.
    - .2        Review manufacturer's installation instructions and warranty requirements.
  - .2        Departmental Representative to establish communication procedures for:
    - .1        Notifying construction warranty defects.
    - .2        Determine priorities for type of defects.
    - .3        Determine reasonable response time.
  - .3        Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
  - .4        Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

**1.3                SUBMITTALS**

- .1        Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Two (2) weeks prior to Substantial Performance of the Work, submit to the Departmental Representative four (4) final copies of operating and maintenance manuals in English and French.
- .3        Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4        Provide evidence, if requested, for type, source and quality of products supplied.

**1.4                FORMAT**

- .1        Organize data as instructional manual.
- .2        Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

- .3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and 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 scaled CAD files in .dwg format on CD.

## **1.5 CONTENTS - EACH VOLUME**

- .1 Table of Contents: provide title of project;
  - .1 Date of submission; names.
  - .2 Addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

## **1.6 AS-BUILTS AND SAMPLES**

- .1 Maintain, in addition to requirements in General Conditions, at site for Owner one (1) record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.

- .4 Change Orders and other modifications to Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

#### **1.7 RECORDING ACTUAL SITE CONDITIONS**

- .1 Record information on set of red lined drawings, provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to 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 internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.

- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photographs, if requested, for site records.

## **1.8 FINAL SURVEY**

- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

## **1.9 EQUIPMENT AND SYSTEMS**

- .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 curves, with 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 co-ordination 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 test and balancing reports.

## **1.10 MATERIALS AND FINISHES**

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, 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 Moisture-Protection and Weather-Exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

## **1.11 MAINTENANCE MATERIALS**

- .1 Spare Parts:
  - .1 Provide spare parts, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
  - .1 Provide maintenance and extra materials, in quantities specified in individual specifications sections.
  - .2 Provide items of same manufacturer and quality as items in Work.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
  - .1 Provide special tools, in quantities specified in individual specification sections.
  - .2 Provide items with tags identifying their associated function and equipment.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.

- .2 Include approved listings in Maintenance Manual.

**1.12 DELIVERY, STORAGE AND HANDLING**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

**1.13 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:
- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.



- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
  - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include transformers and commissioned systems.
  - .3 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 Name and phone numbers of manufacturers or suppliers.
    - .5 Names, addresses and telephone numbers of sources of spare parts.
    - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
    - .7 Cross-reference to warranty certificates as applicable.
    - .8 Starting point and duration of warranty period.
    - .9 Summary of maintenance procedures required to continue warranty in force.
    - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
    - .11 Organization, names and phone numbers of persons to call for warranty service.
    - .12 Typical response time and repair time expected for various warranted equipment.
  - .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
  - .5 Procedure and status of tagging of equipment covered by extended warranties.
  - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification will follow oral instructions. Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

#### **1.14 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.

- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for 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 Construction Contractor.

**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                SECTION INCLUDES**

- .1            Methods for removal of existing asphalt pavement.

**1.2                RELATED SECTIONS**

- .1            Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

**1.3                MEASUREMENT PROCEDURES**

- .1            Included in Balance of Project.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2            Removed asphalt shall be taken to a recycling facility.

**Part 2            Products**

**2.1                EQUIPMENT**

- .1            Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.

**Part 3            Execution**

**3.1                PREPARATION**

- .1            Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed.
- .2            Sawcut extent of asphalt to be removed. Sawcut and prepare step connection where indicated and as per detail drawings.

**3.2                PROTECTION**

- .1            Protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.

**3.3            REMOVAL**

- .1        Remove existing asphalt pavement to lines and grades as indicated.
- .2        Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
- .3        Provide for suppression of dust generated by removal process.

**3.4            SWEEPING**

- .1        Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1    Section 01 35 29.06 – Health and Safety Requirements.
- .2    Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .3    Section 31 05 16 – Aggregate Materials.
- .4    Section 32 11 23 – Aggregate Base Courses.
- .5    Section 32 16 15 – Concrete Walks, Curbs and Gutters.

**1.2                MEASUREMENT FOR PAYMENT**

- .1    No measurement for payment will be made under this section. Include costs in items where required.

**1.3                REFERENCES**

- .1    American Society for Testing and Materials International (ASTM)
  - .1    ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2    ASTM C309-03, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3    ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
  - .4    ASTM C1017/C1017M-03, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .5    ASTM D412-98a (2002) e1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .6    ASTM D624-00e1, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .7    ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .8    ASTM D1752-04a, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2    Canadian General Standards Board (CGSB)
  - .1    CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.

- .2 CAN/CGSB-51.34-M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
  - .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-installation meeting once week prior to beginning concrete work.
  - .1 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor – finishing, forming attend.
    - .1 Verify project requirements.

#### **1.5 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken.
- .4 Concrete hauling time: submit for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .5 Provide two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 – Health and Safety Requirements and Section 01 35 43 – Environmental Procedures.

#### **1.6 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Submit to Departmental Representative, minimum 4 weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
  - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Departmental Representative on following items:

- .1 Curing.
- .2 Finishes.
- .3 Joints.
- .4 Quality Control Plan: submit written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
    - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
    - .2 Deviations to be submitted for review by Departmental Representative.
  - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

## **Part 2 Products**

### **2.1 DESIGN CRITERIA**

- .1 Performance: to CSA A23.1/A23.2.

### **2.2 PERFORMANCE CRITERIA**

- .1 Quality Control Plan: Ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance.

### **2.3 MATERIALS**

- .1 Cement: to CAN/CSA-A3001, Type GU.
- .2 Water: to CSA-A23.1.
- .3 Aggregates: to CAN/CSA-A23.1/A23.2.
- .4 Admixtures:
  - .1 Air entraining admixture: to ASTM C260.
  - .2 Chemical admixture: to ASTM C494 ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .5 Curing compound: to CSA-A23.1/A23.2 white.

## **2.4 MIXES**

- .1 Performance Method for specifying concrete: to meet Departmental Representative performance criteria in accordance with CAN/CSA-A23.1/A23.2.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
    - .1 Compressive strength at 28 days: 32 MPa minimum.
  - .2 Provide quality management plan to ensure verification of concrete quality to specified performance.
  - .3 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete.
  - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .3 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .4 Protect previous Work from staining.
- .5 Clean and remove stains prior to application for concrete finishes.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, and air temperature and test samples taken.
- .7 Do not place load upon new concrete until authorized by Departmental Representative.

### **3.2 CONSTRUCTION**

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Finishing and curing:
  - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
  - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA-A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.



- .3 Joint fillers:
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
  - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
  - .3 Locate and form expansion joints per OPSD Standards.
  - .4 Install joint filler.
  - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

### **3.3 SURFACE TOLERANCE**

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2.

### **3.4 FIELD QUALITY CONTROL**

- .1 Site tests: conduct following test as follows in accordance with Section 01 45 00 - Quality Control and submit report for the following:
  - .1 Concrete pours.
  - .2 Slump tests.
  - .3 Air Content.
  - .4 Compressive Strength at 7 and 28 days.
  - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review in accordance with CSA-A23.1/A23.2.
  - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
- .4 Contractor will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

**3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
  - .1 Divert unused concrete materials to local quarry.
  - .2 Provide appropriate area on job site where concrete trucks can be safely washed.
  - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
  - .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.
  - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
  - .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.
  - .7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

**END OF SECTION**

**Part 1          General**

**1.1            GENERAL**

- .1      This section covers items common to Sections of Division 26. This section supplements requirements of Division 1.

**1.2            REFERENCES**

- .1      Perform all work to meet or exceed the requirements of the Canadian Electrical Code, CSA Standard C22.1 - (latest edition).
- .2      Consider CSA Electrical Bulletins in force at time of tender submission, while not identified and specified by number in this Division, to be forming part of related CSA Part II standard.
- .3      Do overhead and underground systems in accordance with CSA C22.3 except where specified otherwise.
- .4      Where requirements of this specification exceed those of above mentioned standards, this specification shall govern.
- .5      Notify the NRC Departmental Representative as soon as possible when requested to connect equipment supplied by NRC which is not CSA approved.
- .6      Refer to Sections 00 10 00 & 0015 45.

**1.3            DEFINITIONS**

- .1      Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

**1.4            DESIGN REQUIREMENTS**

- .1      “Inspection Authority” means Electrical Safety Authority.
- .2      “Supply Authority” means Hydro Ottawa.
- .3      “Provide” means supply and install.
- .4      Operating voltages: to CAN3-C235.
- .5      Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1      Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

- .6 Language operating requirements: provide identification nameplates for control items in English and French.
- .7 Use one nameplate for both languages.

## **1.5 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop drawings:
  - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, and other items that must be shown to ensure co-ordinated installation.
  - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
  - .3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .4 Submit 6 copies of 600 x 600 mm minimum size drawings and product data.
  - .5 If changes are required, notify Engineer of these changes before they are made.
- .3 Submit to Inspection Authority and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .4 Pay associated fees and obtain all permits required for the performance of the work.
- .5 Quality Control:
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
  - .6 Submit certificate of acceptance from inspection authority upon completion of Work to Engineer.
- .6 Manufacturer's Field Reports: submit to Engineer manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

## 1.6 QUALITY ASSURANCE

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .2 Site Meetings:
  - .1 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
    - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
    - .2 Twice during progress of Work at 25% and 60% complete.
    - .3 Upon completion of Work, after cleaning is carried out.
- .3 The project manager and site foreman assigned to this project shall be consistent from project start to project completion. No substitutions shall be permitted without written approval/acceptance from the Engineer and Owner.

## 1.7 STARTUP

- .1 Instruct the NRC Departmental Representative and operating personnel in the operation, care and maintenance of equipment supplied under this contract.

## 1.8 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.

- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

## **1.9 LOCATION OF EQUIPMENT AND FIXTURES**

- .1 Location of equipment and fixtures indicated or specified are to 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 Engineer of impending installation and obtain his approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

## **1.10 EXISTING SERVICES**

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by governing authorities, with minimum of disturbance to pedestrian and vehicular traffic.
- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Record locations of maintained, re-routed and abandoned service lines.

## **1.11 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

- .2 Where security has been reduced by work of Contract, provide temporary means to maintain security.
- .3 Where elevators, dumbwaiters, conveyors or escalators exist in building, only those assigned for Contractor's use may be used for moving men and materials within building. Protect walls of passenger elevators, to approval of Departmental Representative before use. Accept liability for damage, safety of equipment and overloading of existing equipment.
- .4 Provide temporary dust screens, barriers, warning signs in locations where renovation and alteration work is adjacent to areas used by public or government staff.

#### **1.12 ADDITIONAL DRAWINGS**

- .1 Engineer may furnish additional drawings to assist proper execution of work. These drawings will be issued for clarification only. Such drawings shall have same meaning and intent as if they were included with plans referred to in contract documents.

#### **1.13 GUARANTEES**

- .1 Before completion of work collect all agreements, guarantees and warranties and deposit with Departmental Representative.
- .2 Work to be guaranteed for a period of one full year from the date of practical completion, unless specified otherwise.
- .3 Final payment will not be released prior to receipt in writing of all guarantees.

#### **1.14 CONTRACT**

- .1 Project drawings and specifications are complimentary to this General Specification. In cases of conflict, ambiguity or doubt, apply to the Departmental Representative for a ruling in writing.
- .2 All jobs must be complete, performed and finished in a workmanlike manner. Work and materials of an incidental nature, necessary by implication to produce the finished job as specified, shall be supplied, even when not listed or described in detail.
- .3 No deviations from the specifications or drawings will be allowed without written permission of the Departmental Representative.

#### **1.15 WIRING TERMINATIONS**

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for 90 degree C rated conductors, either copper or aluminum. Where existing equipment is rated for less than 90 degree C, transition to lower temperature rating 1.5 meters from termination point using larger sized wire and conduit to suit.

### **1.16 COST BREAKDOWN**

- .1 Submit an itemized breakdown of the contract price before submitting the first application for payment.
- .2 In this breakdown, present separate prices for the distribution equipment, fixtures, branch wiring, special equipment and other items as required by the Engineer. Indicate labour/material breakdown separately. No progress payment will be approved until this breakdown has been presented in an approved form.

### **1.17 AS-BUILT DRAWINGS BY CONTRACTOR**

- .1 The successful contractor shall be responsible for a complete set of as-built drawings.
- .2 A set of prints shall be kept up-to-date as the work progresses. Show all changes and deviations from the original tender documents whether they be issued change orders, site instructions or contractor's changes.
- .3 Record exactly the location of services where concealed or buried or where capped or plugged for future use. As-built drawings shall show conduit sizes and runs, junction boxes, pull boxes, wiring with circuit numbers.
- .4 The Engineer shall make available the Tender Issue of the drawings. This contractor shall update these with all Change Orders, Site Instructions, and to reflect site conditions.
- .5 The Engineer reserves the right to request a number of verifications necessary to prove the exactness of the as-built drawings.
- .6 Upon completion of the Project, the contractor shall turn over a complete set of as-built drawings (marked up white prints in red ink) to the Engineer. The Engineer shall incorporate information received via the as-built drawings onto a set of Record Drawings for the Client.

### **1.18 CONSTRUCTION DRAWINGS AND SPECIFICATIONS**

- .1 Following execution of the contract, an "Issued for Construction" revision of the drawings and specifications, which incorporates all addenda issued during the tender period, will be prepared by the Engineer and provided to the contractor for their review. The contractor shall review the "Issued for Construction" drawings and specifications to confirm that all addenda are included and confirm the contractor's acceptance in writing back to the Engineer.
- .2 The "Issued for Construction" drawings and specifications will be provided to the contractor for his initial review no later than 3 weeks following execution of the contract. No claims for delays by the contractor will be considered relating to this schedule.



- .3 Following acceptance of the “Issued for Construction” drawings and specifications by the contractor, the Engineer will supply the following items to the Prime Consultant for distribution to the contractor:
  - .1 Email electronic (pdf) files of the entire set of “Issued for Construction” drawings and specifications.
  - .2 One (1) CD containing the entire set of “Issued for Construction” drawings and specifications in electronic (pdf) files.
- .4 Electronic drawings in Autocad (ACAD) 2008 format may be available to the contractor at the Engineer’s discretion. The contractor will be responsible to sign a release form provided by the Engineer prior to receiving ACAD drawings. ACAD drawings will only be provided on a case by case basis at the Engineer’s discretion and the contractor will be expected to justify the need for the ACAD drawings. Note that some ACAD drawings may require additional Autodesk software to be fully compatible (ie. Autocad MEP, etc.).

#### **1.19 DEMOLITION**

- .1 Full extent of demolition is not illustrated on drawings. All services under equipment which have become redundant under the contract shall be removed. All items removed during demolition and which are not to be re-used shall be removed from site.
- .2 Contractor to relocate any electrical items which interfere with the new construction and may not appear on drawings.
- .3 Contractor is responsible for the reconnection of any services which are to remain and which have been disconnected during the course of demolition or construction.
- .4 All equipment to be re-used is to be cleaned of paint, plastic, etc. to the satisfaction of the Engineer.
- .5 Where indicated, existing site lighting fixtures, poles and bases are to be removed. Existing redundant underground ducts shall be abandoned.
- .6 Contractor is responsible for reconnecting any existing loads which do not appear on panel details and which are to be re-used.
- .7 Where existing materials are to be re-used, the contractor for this Division is responsible for their removal, storage, cleaning and reinstallation.
- .8 Turn over to the Owner any redundant existing material or equipment designated by the Owner or specified on drawings.
- .9 Where some existing materials or equipment are to be retained in place or reconnected, it is the responsibility of the contractor of this Division to identify and protect the materials or equipment prior to the commencement of demolition.

- .10 Maintain adequate structural support for equipment and material during demolition process.
- .11 It is the responsibility of this Contractor to maintain electrical services and systems at all times to areas beyond the construction area.
- .12 Reinstate immediately any existing services disrupted during demolition not intended to be removed as part of this contract.

**1.20 SITE VISIT**

- .1 Acquire a full working knowledge of the building site and any existing conditions thereon which might affect any aspect of the job. Inspect the contract drawings for all trades since no extras will be entertained for work which could otherwise have been foreseen by prior inspection of the site and/or the contract drawings.

**1.21 PERMITS AND FEES**

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay all fees required for the performance of the work.

**1.22 INSPECTION AND FEES**

- .1 Furnish a Certificate of Acceptance from the Authorized Electrical Inspection Department on completion of work.
- .2 Request and obtain Special Inspection approval from the Authorized Electrical Inspection Department for any non-CSA approved control panels or other equipment fabricated by the contractor as part of this contract.
- .3 Pay all fees required for inspections.

**1.23 COOPERATION**

- .1 Before commencing work, examine the contract drawings and schedules of all other trades. Report at once to the Engineer any interference which might affect the scheduling of, or performance of, work under this Division.
- .2 During construction, ensure that interference with the work of other trades is kept to a minimum and that the finished work of other trades is protected against damage from the electrical work.

- .3 Coordinate any opening or sleeves required for the installation of circuits or equipment so as not to interrupt the progress of masonry and concrete work.
- .4 Obtain approval from the Engineer, or from the Contractor responsible for structural members, before any openings are cut in structural supports, either concrete or steel.

#### **1.24 CUTTING, FITTING AND PATCHING**

- .1 Execute cutting (including excavation), fitting and patching required to make work fit properly.
- .2 Where new work connects with existing and where existing work is altered, cut, patch and make good to match existing work.
- .3 Obtain Engineer's approval before cutting, boring or sleeving load-bearing members.
- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .5 Fit work airtight to sleeves, ducts and conduits.
- .6 Scanning of concrete floor slab is required before cutting to locate existing rebars and conduits and to obtain Owner's approval for proposed cutting or core drilling. Repair all existing work damaged by cutting or core drilling at no extra cost to the contract.

#### **1.25 SHUTDOWN OF SERVICES AND SYSTEMS**

- .1 All shut-down to be in accordance with Division 1.
- .2 Contractors are to verify with Owner before making any connection to any existing systems. This will ensure that (1) the Owner is aware that work will be done on a system and (2) that the contractor is working on a system that is working when he starts his work.

#### **1.26 CHANGES IN THE WORK**

- .1 Changes in the work may be requested from time to time by the issuance of a Contemplated Change Notice (CCN) and/or Proposed Change (PC). In addition to the net cost of the change, the Contractor shall be entitled to a 15% fee to cover overheads & profit on his work and a 10% fee to cover overheads and profit on sub-trades.
- .2 Provide detailed breakdowns of material and labour with unit prices and extensions required for review of Contemplated Change Notices (CCN's) or Proposed Changes (PC's).

- .3 Cost quotations shall be based on industry accepted costing methods. Wiring, conduit and similar commodity-type materials shall be based on current Trade Service Canadian Monitor Plus net pricing with a 30% discount applied. Submit supplier invoices for other types of material such as power distribution equipment, light fixtures, heating products, fire alarm components, etc.
- .4 Blended labour rates for all personnel for the duration of the project shall not exceed the following:
  - .1 Normal working hours: \$83.00 / hour
  - .2 Premium night shift (minimum three consecutive night shifts): \$110.00 / hour
  - .3 Overtime: \$137.00 / hour
- .5 Required labour shall be evaluated based on published NECA Manual of Labour Units, current at time of tender closing, using the “normal” column for unoccupied areas and the “difficult” column in occupied areas or areas of excessively high ceilings, subject to Engineer’s review. No other Job Factors shall be considered applicable.
- .6 The following job expenses shall be considered to be acceptable in certain pricing exercises:
  - .1 Bonding costs.
  - .2 Warranty costs where considered acceptable shall be based on 2% of the material & labour cost for the change.
  - .3 Drafting costs (where interference /coordination drawings have been requested as part of the contract) shall be considered based on 2% of the labour cost for the change. Equipment costs will not be considered in the formula.
  - .4 Hoisting where considered acceptable (ie. Crane is off site) shall be charged based on current craning costs.
  - .5 Equipment rentals for large equipment (ie. Not small tools covered in the labour units) shall be charged based on current rental rates.
  - .6 Core drilling where considered acceptable shall be charged as a job expense.
  - .7 Travel in accordance with the applicable union agreement shall be considered to be acceptable as a job expense.
- .7 The following job expenses shall NOT be considered acceptable under any circumstances:
  - .1 Supervision (foreman, site superintendent, etc – covered in blended rate above).
  - .2 Garbage Bins/Clean-up.
  - .3 Shipping and deliveries.
  - .4 Project Management.
  - .5 Estimating.
  - .6 Special Cleaning.
  - .7 Special Handling / Storage.
  - .8 Equipment rentals for small tools.
  - .9 Equipment Start-up.
  - .10 Any other Non Productive Time items

- .8 The Electrical Contractor shall submit a template proposed to be used for any CCN's/PC's as a formal shop drawing submission for review and recommended acceptance prior to any CCN's/PC's being issued.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Provide material and equipment in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

### **2.2 WARNING SIGNS AND PROTECTION**

- .1 Provide warning signs, as specified or to meet requirements of Authorized Electrical Inspection Department and NRC Departmental Representative.
- .2 Accept the responsibility to protect those working on the project from any physical danger due to exposed live equipment such as panel mains, outlet wiring, etc. Shield and mark all live parts with the appropriate voltage. Caution notices shall be worded in both English and French.

### **2.3 WIRING TERMINATIONS**

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

### **2.4 EQUIPMENT IDENTIFICATION**

- .1 Identify with 3mm (1/8") Brother, P-Touch non-smearing tape, or an alternate approved by the NRC Departmental Representative, all electrical outlets shown on drawings and/or mentioned in the specifications. These are the lighting switches, recessed and surface mounted receptacles such as those in offices and service rooms and used to plug in office equipment, telecommunication equipment or small portable tools. Indicate only the source of power (Ex. for a receptacle fed from panel L32 circuit #1: "L32-1").
- .2 Light fixtures are the only exceptions for electrical equipment identification (except as noted in 7.13 below). They are not to be identified.

- .3 Identify with lamicoïd nameplates all electrical equipment shown on the drawings and/or mentioned in the specification such as motor control centers, switchgear, splitters, fused switches, isolation switches, motor starting switches, starters, panelboards, transformers, high voltage cables, industrial type receptacles, junction boxes, control panels, etc., regardless of whether or not the electrical equipment was furnished under this section of the specification.
- .4 Coordinate names of equipment and systems with other Divisions to ensure that names and numbers match.
- .5 Wording on lamicoïd nameplates to be approved by the NRC Departmental Representative prior to fabrication.
- .6 Provide two sets of lamicoïd nameplates for each piece of equipment; one in English and one in French.
- .7 Lamicoïd nameplates shall identify the equipment, the voltage characteristics and the power source for the equipment. Example: A new 120/240 volt single phase circuit breaker panelboard, L16, is fed from panelboard LD1 circuit 10.

"PANEL L16  
120/240 V  
FED FROM LD1-10"

PANNEAU L16  
120/240 V  
ALIMENTE PAR LD1-10

- .8 Provide warning labels for equipment fed from two or more sources - "DANGER MULTIPLE POWER FEED" black letters on a yellow background. These labels are available from NRC's Facilities Maintenance group in building M-19.
- .9 Lamicoïd nameplates shall be rigid lamicoïd, minimum 1.5 mm (1/16") thick with:
  - .1 Black letters engraved on a white background for normal power circuits.
  - .2 Black letters engraved on a yellow background for emergency power circuits.
  - .3 White letters engraved on a red background for fire alarm equipment.
- .10 For all interior lamicoïd nameplates, mount nameplates using two-sided tape.
- .11 For all exterior lamicoïd nameplates, mount nameplates using self-tapping 2.3 mm (3/32") dia. slot head screws - two per nameplate for nameplates under 75 mm (3") in height and a minimum of 4 for larger nameplates. Holes in lamicoïd nameplates to be 3.7 mm (3/16") diameter to allow for expansion of lamicoïd due to exterior conditions.
  - .1 No drilling is to be done on live equipment.
  - .2 Metal filings from drilling are to be vacuumed from the enclosure interiors.

- .12 All lamicoïd nameplates shall have a minimum border of 3 mm (1/8"). Characters shall be 9 mm (3/8") in size unless otherwise specified.
- .13 Identify lighting fixtures which are connected to emergency power with a label "EMERGENCY LIGHTING/ÉCLAIRAGE D'URGENCE", black letters on a yellow background. These labels are available from NRC's Facilities Maintenance group in building M-19.
- .14 Provide neatly typed updated circuit directories in a plastic holder on the inside door of new panelboards.
- .15 Carefully update panelboard circuit directories whenever adding, deleting, or modifying existing circuitry.

## **2.5 WIRING IDENTIFICATION**

- .1 Unless otherwise specified, identify wiring with permanent indelible identifying markings, using either numbered or coloured plastic tapes on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.

## **2.6 CONDUIT AND CABLE IDENTIFICATION**

- .1 All new conduits to be factory painted, colour-coded EMT, type as follows:
  - .1 Fire alarm – red conduit
  - .2 Emergency power circuits – yellow conduit
  - .3 Voice/data – blue conduit
  - .4 Gas detection system – purple conduit
  - .5 Building Automation system – orange conduit
  - .6 Security system – green conduit
  - .7 Control system – black conduit
- .2 Apply paint to the covers of junction boxes and condulets of existing conduits as follows:
  - .1 Fire alarm – red
  - .2 Emergency power circuits – yellow
  - .3 Voice/data – blue
  - .4 Gas detection system – purple
  - .5 Building Automation system – orange
  - .6 Security system – green
  - .7 Control system - black
- .3 For system running with cable, half-lap wrap with dedicated coloured PVC tape to 100 mm width, tape every 5 m and both sides where cable penetrates a wall.

- .4 All other systems need not be coloured.

## **2.7 FINISHES**

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
  - .2 Indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

## **2.8 ACOUSTICAL PERFORMANCE**

- .1 In general provide equipment producing minimal sound levels in accordance with the best and latest practices established by the electrical industry.
- .2 Do not install any device or equipment containing a magnetic flux path metallic core, such as gas discharge lamp ballasts, dimmers, solenoids, etc., which are found to produce a noise level exceeding that of comparable available equipment.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

### **3.2 MANUFACTURER'S & APPROVALS LABELS**

- .1 Ensure that manufacturer's registration plates are properly affixed to all apparatus showing the size, name of equipment, serial number, and all information usually provided, including voltage, cycle, phase and the name and address of the manufacturer.
- .2 Do not paint over registration plates or approval labels. Leave openings through insulation for viewing the plates. Contractor's or sub-contractor's nameplate not acceptable.

### **3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: sized for free passage of conduit, and protruding 50 mm.



### **3.4 CO-ORDINATION OF PROTECTIVE DEVICES**

- .1 Ensure circuit protective devices such as overcurrent trips, fuses, are installed to values and settings as indicated on the Drawings.

### **3.5 FIELD QUALITY CONTROL**

- .1 Furnish a Certificate of Acceptance from Inspection Authority on completion of work
- .2 Load Balance:
  - .1 Measure phase current to new panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes, and revise panelboard schedules.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Conduct following tests:
  - .1 Provide any materials, equipment and labour required and make such tests deemed necessary to show proper execution of this work, in the presence of the NRC Departmental Representative.
  - .2 Correct any defects or deficiencies discovered in the work in an approved manner at no additional expense to the Owner.
  - .3 Megger all branch circuits and feeders using a 600V tester for 240V circuits and a 1000V tester for 600V circuits. If the resistance to ground is less than permitted by Table 24 of the Code, consider such circuits defective and do not energize.
  - .4 The final approval of insulation between conductors and ground, and the efficiency of the grounding system is left to the discretion of the local Electrical Inspection Department.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 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.

### **3.6 GROUNDING**

- .1 Thoroughly ground all electrical equipment, cabinets, metal supporting frames, ventilating ducts and other apparatus where grounding is required in accordance with the requirements of the latest edition of the Canadian Electrical Code Part 1, C.S.A. C22.1 and corresponding Provincial and Municipal regulations. Do not depend upon conduits to provide the ground circuits.
- .2 Run separate green insulated stranded copper grounding conductors in all electrical conduits including those feeding toggle switches and receptacles.

### **3.7 MOTOR ROTATION**

- .1 For new motors, ensure that motor rotation matches the requirements of the driven equipment.
- .2 For existing motors, check rotation before making wiring changes in order to ensure correct rotation upon completion of the job.

### **3.8 WORK ON LIVE EQUIPMENT & PANELS**

- .1 NRC requires that work be performed on non-energized equipment, installation, conductors and power panels. For purposes of quotation assume that all work is to be done after normal working hours and that equipment, installation, conductors and power panels are to be de-energized when worked upon.

### **3.9 CLEANING**

- .1 Provide cleaning in accordance with Section 01 74 11 – Cleaning.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

### **3.10 CLOSEOUT SUBMITTALS**

- .1 Provide closeout documentation in accordance with Section 01 78 00 – Closeout Submittals.

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1            Materials and installation for wire and box connectors.

**1.2            REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2            CSA C22.2 No.65-93(R1999), Wire Connectors.
- .2            Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1            EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3            National Electrical Manufacturers Association (NEMA)

**1.3            WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials.
- .2            Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3            Collect and separate for disposal paper, metal, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Construction Manager's Waste Management Plan.
- .4            Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

**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.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 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.
  - .2 Install fixture type connectors and tighten. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with NEMA.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS            -**

- .1        Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

**1.2                REFERENCES**

- .1        CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

**1.3                PRODUCT DATA**

- .1        Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, metal, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Construction Manager's Waste Management Plan.
- .4        Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

**Part 2            Products**

**2.1                WIRES**

- .1        Conductors shall be copper, stranded for 10 AWG and        larger. Minimum size: 12 AWG.
- .2        Size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE or RWU90 XLPE, Non Jacketted. Use RWU90 for underground and outdoor circuits and feeders.

**2.2                ARMOURED CABLES**

- .1        Conductors: insulated, copper, size as indicated.
- .2        Type: AC90.
- .3        Armour: interlocking type fabricated from aluminum strip.

- .4 Connectors: anti short connectors.

### **2.3 CONTROL CABLES**

- .1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:
  - .1 Insulation: thermoplastic.
  - .2 Sheath : thermoplastic jacket, FT-6 rated.
- .2 Type: 600 V stranded copper conductors, minimum size 16AWG.
  - .1 Insulation: RW90 (x-link).

## **Part 3 Execution**

### **3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

### **3.2 GENERAL CABLE INSTALLATION**

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

### **3.3 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

### **3.4 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible on channels.
- .2 Use only above ceiling or in partitions, 3 meter maximum length.

### **3.5 INSTALLATION OF CONTROL CABLES**

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

### **3.6 INSTALLATION OF UNDERGROUND WIRES**

- .1 Install wiring as follows:
  - .1 In underground conduit systems in accordance with Sections 26 05 34, 26 05 43.01, 33 65 76 and 33 71 73.02.

**END OF SECTION**





**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 26 05 00 - Common Work Results - Electrical.

**1.2                REFERENCES**

- .1        Canadian Standards Association, (CSA International)

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, metal, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Construction Manager's Waste Management Plan.
- .4        Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

**Part 2            Products**

**2.1                EQUIPMENT**

- .1        Copper conductor: minimum 6m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .2        Rod electrodes: copper clad steel 19mm by 3m long.
- .3        Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .4        Insulated grounding conductors: green, type to Section 26 05 21.
- .5        Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1        Grounding and bonding bushings.
  - .2        Protective type clamps.
  - .3        Bolted type conductor connectors.
  - .4        Thermit welded type conductor connectors.
  - .5        Bonding jumpers, straps.
  - .6        Pressure wire connectors.

**Part 3 Execution**

**3.1 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Provide separate insulated ground wire in all conduits.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install separate ground conductor to outdoor lighting standards.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

**3.2 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Distribution panels, outdoor lighting.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 – Common Work Results for Electrical.

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

- .1            U shape, size 41 x 41 mm, 2.5 mm thick, surface Mounted.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Secure equipment to masonry, tile and plaster surfaces with nylon shields.
- .2            Secure equipment to poured concrete with expandable inserts.
- .3            Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4            Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5            Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6            Fasten exposed conduit or cables to building construction or support system using straps.
  - .1            One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2            Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3            Beam clamps to secure conduit to exposed steel work.
- .7            Suspended support systems.
  - .1            Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2            Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8            Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9            Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

**Part 1            General**

**1.1                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

**Part 2            Products**

**2.1                SPLITTERS**

- .1        Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2        Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3        Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

**2.2                JUNCTION AND PULL BOXES**

- .1        Construction:welded steel enclosure.
- .2        Covers Flush Mounted: 25 mm minimum extension all around.
- .3        Covers Surface Mounted: screw-on flat covers.

**2.3                CABINETS**

- .1        Construction: welded sheet steel hinged door, latch lock 2 keys and catch
- .2        Type E Empty: surface return flange mounting as indicated.
- .3        Type T Terminal: surface return flange mounting as indicated containing 19 mm G1S plywood backboard.

**Part 3            Execution**

**3.1                SPLITTER INSTALLATION**

- .1        Mount plumb, true and square to building lines.
- .2        Extend splitters full length of equipment arrangement except where indicated otherwise.

**3.2                JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1        Install pull boxes in inconspicuous but accessible locations.

- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

### **3.3 IDENTIFICATION**

- .1 Equipment Identification: to Section 26 05 00- Common Work Results for Electrical .
- .2 Identification Labels: size 2 indicating voltage and phase or as indicated.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA C22.2 No. 18.1-13, Metallic Outlet Boxes.
  - .2 CSA C22.2 No. 45-07(R2012), Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.

**1.2                WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, metal, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Construction Manager's Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

**Part 2            Products**

**2.1                CABLES AND REELS**

- .1 Provide cables on reels or coils.
  - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.

**2.2                CONDUITS**

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

- .4 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

### **2.3 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
  - .1 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.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

### **2.4 CONDUIT FITTINGS**

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.  
Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
  - .1 Set-screws are not acceptable.

### **2.5 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.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

### **2.6 FISH CORD**

- .1 Polypropylene.

## **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**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Surface mount conduits except within partitions.
- .4 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.
- .5 Use rigid pvc conduit underground and in corrosive areas.
- .6 Use flexible metal conduit for connection to motors in dry areas.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Use explosion proof flexible connection for connection to explosion proof motors.
- .9 Install conduit sealing fittings in hazardous areas.
  - .1 Fill with compound.
- .10 Minimum conduit size shall be 21mm.
- .11 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .12 Mechanically bend steel conduit over 19 mm diameter.
- .13 Install fish cord in empty conduits.
- .14 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

### **3.3 CONDUITS IN CAST-IN-PLACE CONCRETE**

- .1 Protect conduits from damage where they stub out of concrete.

### **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 UNDERGROUND**

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

### **3.7 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Canadian Standards Association, (CSA International)
- .2        Insulated Cable Engineers Association, Inc. (ICEA)

**1.2                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4        Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5        Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

**Part 2            Products**

**2.1                CABLE PROTECTION**

- .1        38 x 140 mm planks pressure treated with clear or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

**Part 3            EXECUTION**

**3.1                CABLE INSTALLATION IN DUCTS**

- .1        Install cables as indicated in ducts.
  - .1        Do not pull spliced cables inside ducts.
- .2        Install multiple cables in duct simultaneously.
- .3        Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4        To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
  - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
  - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
  - .1 Ensure that terminations and accessory equipment are disconnected.
  - .2 Ground shields, ground wires, metallic armour and conductors not under test.
  - .3 High Potential (Hipot) Testing.
    - .1 Conduct hipot testing at original factory test voltage in accordance with manufacturer's recommendations.
- .7 Provide Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1    CSA International
  - .1    CAN/CSA-C22.2 No.47-13 Air-Cooled Transformers (Dry Type).
  - .2    CSA C9-02(R2011), Dry-Type Transformers.
  - .3    CAN/CSA-C802.2-12, Minimum Efficiency Values for Dry Type Transformers.
- .2    National Electrical Manufacturers Association (NEMA)

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.

**1.3                CLOSEOUT SUBMITTALS**

- .1    Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2    Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

**Part 2            Products**

**2.1                DESIGN DESCRIPTION**

- .1    Design 1.
  - .1    Type: ANN.
  - .2    Single or 3 phase size, primary and secondary voltage as indicated
  - .3    Voltage taps: standard to 2½% above and 2½% below.
  - .4    Insulation: 150 degrees C temperature rise.
  - .5    Basic Impulse Level (BIL): standard.
  - .6    Hipot: standard.
  - .7    Average sound level: standard
  - .8    Impedance at 170 degrees C: standard
  - .9    Enclosure: CSA Type 2, removable metal front panel.
  - .10    Mounting: floor or wall as indicated.
  - .11    Finish: in accordance with Section 26 05 00 - Common Work Results for Electrical.
  - .12    Copper windings.
  - .13    3 phase shall be true delta-star winding configuration.
  - .14    Voltage Regulation to be 4% or better.

## **2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Label size: 7.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Mount dry type transformers up to 75 kVA as indicated.
- .2 Mount dry type transformers above 75 kVA on floor.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.
- .9 Make conduit entry into bottom 1/3 of transformer enclosure.

### **3.2 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dry type transformers installation.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1            CSA International
  - .1            CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Shop Drawings:
  - .1            Include on drawings:
    - .1            Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**1.3                CLOSEOUT SUBMITTALS    \_**

- .1            Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with manufacturer's written instructions.

**Part 2            Products**

**2.1                PANELBOARDS**

- .1            Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
  - .1            Install circuit breakers in panelboards before shipment.
  - .2            In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2            250 V panelboards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.
- .3            600 V panelboards: bus and breakers rated for 20,000 A (symmetrical) interrupting capacity or as indicated.
- .4            Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .5            Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

- .6 Minimum of 2 flush locks for each panel board.
- .7 Two keys for each panelboard and key panelboards alike.
- .8 Copper bus with neutral of same ampere rating of mains.
- .9 Mains: suitable for bolt-on breakers.
- .10 Trim with concealed front bolts and hinges.
- .11 Trim and door finish: baked enamel.
- .12 CSA Type 1 enclosure in non-sprinklered buildings, CSA Type 2 enclosure in sprinklered buildings.

## **2.2 BREAKERS**

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

## **2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.



- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

### **3.2 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by panelboards installation.

**END OF SECTION**



**Part 1            General**

**1.1                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Provide fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics.

**1.2                DELIVERY, STORAGE AND HANDLING**

- .1        Ship fuses in original containers.
- .2        Do not ship fuses installed in switchboard.
- .3        Store fuses in original containers in moisture free location.

**1.3                EXTRA MATERIALS**

- .1        Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2        Three spare fuses of each type and size installed above 600 A.
- .3        Six spare fuses of each type and size installed up to and including 600 A.

**Part 2            Products**

**2.1                FUSES - GENERAL**

- .1        Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.
- .2        Fuses: product of one manufacturer.

**2.2                FUSE TYPES**

- .1        Class L fuses: use for fuses over 600A.
  - .1        Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2        Type L2, fast acting.
- .2        Class J fuses: use for fuses 600A and below.
  - .1        Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install fuses in mounting devices immediately before energizing circuit.
- .2        Ensure correct fuses fitted to physically matched mounting devices.
- .3        Ensure correct fuses fitted to assigned electrical circuit.
- .4        Install spare fuses in fuse storage cabinet.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1            CSA International
  - .1            CSA C22.2 No. 5-13, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Include time-current characteristic curves for breakers with ampacity of 100 A and over or with interrupting capacity of 20,000 A symmetrical (rms) and over at system voltage.
- .4            Certificates:
  - .1            Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    - .1            Production certificate of origin must be submitted to Departmental Representative for approval.
    - .2            Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
    - .3            Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
    - .4            Production certificate of origin must contain:
      - .1            Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
      - .2            Licensed dealer's name and address and person of distributor responsible for Contractor's account.
      - .3            Contractor's name and address and person responsible for project.

- .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
- .5 Name and address of building where circuit breakers will be installed:
  - .1 Project title
  - .2 End user's reference number.
  - .3 List of circuit breakers.

## **Part 2 Products**

### **2.1 BREAKERS GENERAL**

- .1 Moulded-case circuit breakers and ground-fault circuit-interrupters: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips.
- .6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating to match panels in which they are to be installed.

### **2.2 THERMAL MAGNETIC BREAKERS**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

### **2.3 OPTIONAL FEATURES**

- .1 Include:
  - .1 Shunt trip.
  - .2 On-off locking device.

**Part 3          Execution**

**3.1              INSTALLATION**

- .1          Install circuit breakers as indicated.

**END OF SECTION**





**Part 1            General**

**1.1                REFERENCES**

- .1    CSA Group
  - .1    CAN/CSA-C22.2 No.4-04(R2009), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
  - .2    CSA C22.2 No.39-13, Fuseholder Assemblies.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 – Submittal procedures.
- .2    Product Data:
  - .1    Submit manufacturer`s instructions, printed product literature and data sheets for disconnect switches – fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

**Part 2            Products**

**2.1                DISCONNECT SWITCHES**

- .1    Fusible, Non-fusible, Horsepower rated disconnect switch in CSA enclosure 2, to CAN/CSA-C22.2 No.4 size as indicated.
- .2    Provision for padlocking in on-off switch position by 3 locks.
- .3    Mechanically interlocked door to prevent opening when handle in ON position.
- .4    Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.
- .5    Fuseholders: to CSA C22.2 No.39relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6    Quick-make, quick-break action.
- .7    ON-OFF switch position indication on switch enclosure cover.

**2.2                EQUIPMENT IDENTIFICATION**

- .1    Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2    Indicate name of load controlled on size 4 nameplate.

**Part 3          Execution**

**3.1             INSTALLATION**

- .1          Install disconnect switches complete with fuses if applicable.

**END OF SECTION**

## **Part 1        General**

### **1.1        REFERENCES**

- .1        American National Standards Institute/Institute of Electrical and Electronics Engineers ( ANSI/IEEE )
  - .1        ANSI/IEEE C62.41-[1991], Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .2        ASTM International Inc.
  - .1        ASTM F 1137-[00(2006)], Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .3        Canadian Standards Association (CSA International)
- .4        ICES-005-[07], Radio Frequency Lighting Devices.
- .5        Underwriters' Laboratories of Canada (ULC)

### **1.2        ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2        Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental representative.
  - .3        Photometric data to include: VCP Table.
- .3        Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.
  - .1        Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures.

### **1.3        DELIVERY, STORAGE AND HANDLING**

- .1        Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2        Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 Divert unused metal materials from landfill to metal recycling facility.
- .5 Disposal and recycling of lamps as per local regulations.
- .6 Disposal of old PCB filled ballasts.

## **Part 2 Products**

### **2.1 LAMPS**

- .1 Light emitting diode (LED) equipment for lighting applications: to CSA C22.2No.250.13-12.
- .2 Performance of LED luminaires: to CSA C866-12.
- .3 Provide all required lamps as indicated in fixture list.

### **2.2 DRIVERS**

- .1 Provide LED drivers and accessories as indicated.

### **2.3 FINISHES**

- .1 Light fixture finish and construction to meet ULC listing[s] and CSA certification[s] related to intended installation.

### **2.4 OPTICAL CONTROL DEVICES**

- .1 As indicated in luminaire schedule.

### **2.5 LUMINAIRES**

- .1 As indicated in luminaire schedule.
- .2 Provide gaskets, stops and barriers to form light traps to prevent light leaks.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated plans.
- .2 Provide concrete bases for new poles as indicated on drawings.
- .3 Install fixtures on poles and secure poles to new concrete bases as indicated on drawings.
- .4 Ensure poles and fixtures are properly embedded in earth to accommodate wind load.

**3.2 WIRING**

- .1 Connect luminaires to lighting circuits.

**3.3 LUMINAIRE ALIGNMENT**

- .1 Align luminaires to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

**3.4 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.2 No.206-M1987(R1999), Lighting Poles.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .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 bins for recycling in accordance with Waste Management Plan.
- .4            Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5            Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                ALUMINUM POLES**

- .1            Aluminum poles: to CSA C22.2 No.206 designed for underground wiring and:
  - .1            Mounting on concrete anchor base.
  - .2            Style: Monotube, round tapered G063-T6 aluminum, wall thickness 6 mm.
  - .3            Straight for one or multiple luminaire mounting brackets.
  - .4            Tapered davit for one or multiple luminaires.
  - .5            Access handhole above pole base for wiring connections, with welded-on reinforcing frames bolted-on cover.
  - .6            Size: as indicated in luminaire schedule.
  - .7            Anchor bolts: steel with shims, nuts, washers and covers.
  - .8            Finish: as indicated in luminaire schedule.
  - .9            Grounding lug.

**2.2                LUMINAIRE MOUNTING BRACKETS**

- .1            Mounting brackets aluminum for specified luminaires:
  - .1            Single or multiple brackets as indicated.
  - .2            Arm extension length: as indicated in luminaire schedule.

- .3 Tapered davit type.

## **2.3 LUMINAIRES**

- .1 Luminaire with weatherproof housing and:
  - .1 Lamp type: LED, wattage: as indicated in luminaire schedule.
  - .2 Drivers: 347 V, in accordance with Section 26 50 00 - Lighting.
  - .3 Optical assembly:
    - .1 For LED lamps:
      - .1 Refractor: one piece prismatic virgin acrylic.
      - .2 Gasket: neoprene seal between each LED and housing.
  - .4 Light Distribution:
    - .1 IES distribution Type as indicated in luminaire schedule.
  - .5 Self-locking latches of stainless steel and aluminum.
  - .6 Factory wired including integral driver terminated at terminal block.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install poles true and plumb, complete with brackets in accordance with manufacturer's instructions.
- .2 Install luminaires on pole davits.
- .3 Check luminaire orientation, level and tilt.
- .4 Connect luminaire to lighting circuit.
- .5 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .2        Section 32 91 19.13 – Topsoil Placement and Grading.

**1.2                REFERENCES**

- .1        American Society for Testing and Materials (ASTM) International
  - .1        ASTM D 698-7e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
- .2        CSA International
  - .1        CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .3        Ontario Provincial Standard Specifications (OPSS)
  - .1        OPSS 1004 (November 2012), Material Specification for Aggregates-Miscellaneous.
  - .2        OPSS 1010 (April 2013), Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.

**1.3                SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .1        Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Granular A, B Type II, Select Subgrade to OPSS.
- .2        Unshrinkable fill: concrete to CSA A23.1/A23.2.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1        Verification of Conditions:

- .1 Before commencing work establish locations of buried services on and adjacent to site.
- .2 Evaluation and Assessment:
  - .1 Arrange with appropriate authority for relocation of buried services that interfere with execution of Work. Pay costs of relocating services.
  - .2 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Departmental Representative.
  - .3 Not later than 1 week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill and fill materials proposed for use.
  - .4 Not later than 48 hours before backfilling or filling with approved material, notify Departmental Representative so that compaction tests can be carried out by designated testing agency.
  - .5 Before commencing work, conduct, with Departmental Representative, condition survey of existing structures, trees and plants, lawns, fencing, servicing poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

### **3.2 PREPARATION**

- .1 Temporary Erosion and Sedimentation Control:
  - .1 Use temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, in accordance with sediment and erosion control plan, specific to site, to EPA 832/R-92-005 and requirements of authorities having jurisdiction.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Protection of in-place conditions:
  - .1 Protect excavations from freezing.
  - .2 Keep excavations clean, free of standing water, and loose soil.
  - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.
  - .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
  - .5 Protect buried services that are to remain undisturbed.
- .3 Removal:
  - .1 Remove obsolete buried services within 2m of foundations. Cap cut-offs.
  - .2 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

- .3 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.
- .4 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
- .5 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.

### **3.3 EXCAVATION**

- .1 Topsoil stripping:
  - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
  - .2 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.
  - .3 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.
  - .4 Stockpile in locations as directed by Departmental Representative.
- .2 Excavate as required to carry out work, in all materials met.
  - .1 Do not disturb soil or rock below bearing surfaces. Notify Departmental Representative when excavations are complete.
  - .2 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
  - .3 Fill excavation taken below depths shown without Departmental Representative's written authorization with concrete of same strength as for footings.
- .3 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .4 Excavate for slabs and paving to subgrade levels.
  - .1 Remove topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

### **3.4 SITE QUALITY CONTROL**

- .1 Fill material and spaces to be filled to be inspected and approved by Departmental Representative.

### **3.5 BACKFILLING**

- .1 Start backfilling only after inspection and receipt of written approval of fill material and spaces to be filled from Departmental Representative.

- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill. Fill excavated areas with selected subgrade material compacted as specified for fill.
- .5 Placing:
  - .1 Place backfill, fill and basecourse material in 150 mm lifts. Add water as required to achieve specified density.
  - .2 Place unshrinkable fill in areas as indicated. Consolidate and level unshrinkable fill with internal vibrators.
- .6 Compaction: compact each layer of material to densities as indicated in the geotechnical report or to ASTM D 698 if not otherwise indicated:
  - .1 To underside of basecourses: 95%.
  - .2 Basecourses: 100%.
  - .3 Elsewhere: 90%.
- .7 Under slabs and paving:
  - .1 Use native backfill up to bottom of granular base courses.
  - .2 Use the following for granular courses:
    - .1 Sub-base: minimum 300 mm Granular B Type II.
    - .2 Base: 150 mm Granular A.
- .8 In trenches:
  - .1 Up to 300 mm above pipe or conduit: sand or granular material as directed by Departmental Representative.
  - .2 Over 300 mm above pipe or conduit: native material approved by Departmental Representative.
- .9 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .10 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

### **3.6 GRADING**

- .1 Grade to ensure that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Departmental Representative. Grade to be gradual between finished spot elevations as indicated.

**3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1      Section 31 23 33.01 – Excavation, Trenching and Backfilling.
- .2      Section 32 11 16.01 – Granular Sub-Base.
- .3      Section 32 11 23 – Aggregate Base Courses.
- .4      Section 32 12 16.02 – Asphalt Paving for Building Sites.
- .5      Section 03 30 00 – Cast-in-Place Concrete.

**1.2                REFERENCES**

- .1      American Society for Testing and Materials (ASTM)
  - .1      ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

**1.3                SAMPLES**

- .1      Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Allow continual sampling by Departmental Representative during production.
- .3      Provide Departmental Representative with access to source and processed material for sampling.
- .4      Install sampling to allow Departmental Representative to obtain representative samples of items being produced.
- .5      Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .6      Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1      Divert unused granular materials from landfill to local quarry.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
  - .1 Greatest dimension to exceed five times least dimension.
- .3 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.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
  - .1 Crushed rock.
  - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
  - .3 Light weight aggregate, including slag and expanded shale.

**2.2 SOURCE QUALITY CONTROL**

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in opinion of Departmental Representative, 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.
- .3 Advise Departmental Representative 4 weeks in advance of proposed change of material source.
- .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.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Aggregate source preparation



- .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Departmental Representative.
  - .2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.
  - .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
  - .4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
  - .5 Trim off and dress slopes of waste material piles and leave site in neat condition.
- .2 Processing
- .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
  - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.
  - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.
  - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .3 Handling
- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .4 Stockpiling
- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
  - .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
  - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
  - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
  - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
  - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 h of rejection.
  - .7 Stockpile materials in uniform layers of thickness as follows:
    - .1 Max 1.5 m for coarse aggregate and base course materials.
    - .2 Max 1.5 m for fine aggregate and sub-base materials.
    - .3 Max 1.5 m for other materials.

- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

### **3.2 CLEANING**

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 31 00 99 – Earthwork for Minor Works.

**1.2                MEASUREMENT PROCEDURES**

- .1            No measurement for payment will be made under this Section. Work performed under this Section will be incidental to work in other related sections.

**1.3                REFERENCES**

- .1            American Society for Testing and Materials International (ASTM)
  - .1            ASTM D698-00a, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).

**1.4                DEFINITIONS**

- .1            Reshaping subgrade: scarifying, pulverizing, blading, reshaping and recompacting existing subgrade surface.

**Part 2            Products**

**2.1                NOT USED**

- .1            Not used.

**Part 3            Execution**

**3.1                SCARIFYING AND RESHAPING**

- .1            Pulverize and break down scarified material to 25 mm maximum soil clod size, except that stones larger than this size may be left intact as directed by Departmental Representative.
- .2            Blade and trim pulverized material to elevation and cross section dimensions as indicated.
- .3            Where deficiency of material exists, add and blend additional subgrade material as directed by Departmental Representative.
- .4            Re-use excess material in areas of material deficiency as directed by Departmental Representative.

**3.2 COMPACTING**

- .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D698 or as indicated in the geotechnical report.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade surface.
- .3 Apply water as necessary during compaction to obtain specified density.
- .4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected to value not greater than in accordance with ASTM D698.

**3.3 SITE TOLERANCES**

- .1 Reshaped compacted surface to be within plus or minus 10mm of elevation as indicated.

**3.4 PROTECTION**

- .1 Maintain reshaped surface in condition conforming to this section until succeeding material is applied or until Departmental Representative acceptance.

**3.5 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 01 35 29.06 - Health and Safety Requirements.
- .2            Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**1.2                MEASUREMENT PROCEDURES**

- .1            Quantities will be taken from cross section showing original rock surface and actual grade line set by Departmental Representative.

**1.3                REFERENCES**

- .1            Definitions:
  - .1            Rock: any solid material in excess of 1.0 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.

**1.4                QUALITY ASSURANCE**

- .1            Monitoring:
  - .1            Departmental Representative will visit property holders of adjacent buildings and structures to determine existing conditions and describe rock removal operations and obtain their permission for setting up, if required.
- .2            Vibration Control:
  - .1            Reduce ground vibrations to avoid damage to structures or remaining rock mass.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Not used.

**Part 3            Execution**

**3.1                ROCK REMOVAL**

- .1            Perform excavation in accordance with Erosion and Sedimentation Control Plan.
- .2            Co-ordinate this Section with Section 01 35 29.06 - Health and Safety Requirements.
- .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 to avoid damage to adjacent structures.
- .6 Excavate rock to horizontal surfaces with slope not to exceed 1H:4V.
- .7 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
- .8 Excavate trenches to lines and grades to minimum of 300 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
- .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 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **3.2 ROCK DISPOSAL**

- .1 Dispose of surplus removed rock off site.
- .2 Do not dispose removed rock into landfill. Material must be sent to appropriate quarry.

**END OF SECTION**

**Part 1 General****1.1 RELATED SECTIONS**

- .1 Section 01 35 43 – Environmental Procedures.
- .2 Section 01 51 00 – Temporary Utilities.
- .3 Section 31 00 99 - Earthwork for Minor Works.
- .4 Section 31 05 16 – Aggregate Materials.
- .5 Section 33 05 13 – Manholes and Catch Basin Structures.
- .6 Section 33 41 00 – Storm Utility Drainage Piping.

**1.2 MEASUREMENT PROCEDURES**

- .1 No Measurement for payment will be made under this Section. Work performed under this Section will be incidental to work in other related Sections.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-63 2002, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ; ) (600 kN-m/m ; ).
  - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ; ) (2,700 kN-m/m ; ).
  - .6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 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.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

- .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

#### 1.4 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock: solid material in excess of 1.0 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.
    - .2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

#### 1.5 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:



- .1 Submit condition survey of existing conditions.
  - .2 Submit for review by Departmental Representative proposed dewatering and heave prevention methods.
  - .3 Submit to Departmental Representative written notice at least 5 days prior to excavation work, to ensure cross sections are taken.
  - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
  - .5 Submit to Departmental Representative testing results and report.
- .3 Preconstruction Submittals:
- .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
  - .2 Submit records of underground utility locates, indicating: location plan of relocated and abandoned services, as required.
- .4 Samples:
- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill and unshrinkable fill materials and provide access for sampling.
  - .3 At least 4 weeks prior to beginning Work, inform Departmental Representative source of fly ash and submit samples to Departmental Representative.
    - .1 Do not change source of Fly Ash without written approval of Departmental Representative.

## **1.6 QUALITY ASSURANCE**

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Departmental Representative is employee of Contractor, submit proof that Work by Departmental Representative is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.
- .7 Do not use soil material until written report of soil test results are reviewed and approved by Departmental Representative.
- .8 Health and Safety Requirements:

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert excess materials from landfill to local quarry for reuse.

## **1.8 EXISTING CONDITIONS**

- .1 Buried services:
  - .1 Before commencing work establish location of buried services on and adjacent to 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 2 m of foundations: cap cut-offs.
  - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .5 Prior to beginning excavation Work, notify authorities, including Departmental Representative, and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.
  - .6 Confirm locations of buried utilities by careful soil hydrovac methods.
  - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing. Costs for such Work to be paid by Contractor.
  - .9 Record location of maintained, re-routed and abandoned underground lines.
  - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
  - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative in accordance with Section 32 01 90.33 - Tree and Shrub Preservation.

**Part 2 Products****2.1 MATERIALS**

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

**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.

**3.2 PREPARATION/PROTECTION**

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

**3.3 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Departmental Representative.
  - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

**3.4 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.

- .2 Provide for Departmental Representative's approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures to approved manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

### 3.5 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Remove concrete, paving, walks, curbs and other obstructions encountered during excavation as indicated.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .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 Departmental Representative when bottom of excavation is reached.
- .13 Obtain Departmental Representative approval of completed excavation.

- .14 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .15 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.
  - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .16 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

### **3.6 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 / ASTM D1557.
  - .1 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.

### **3.7 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.8 BACKFILLING**

- .1 Vibratory compaction equipment:
- .2 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Departmental Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
- .3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .6 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 Place layers simultaneously on both sides of installed Work to equalize loading.

### **3.9 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as indicated.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation up to 1.0m beyond the excavation limits.
- .5 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
- .2 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .2 Fertilizers Act (R.S. 1985, c. F-10).
  - .3 Fertilizers Regulations (C.R.C., c. 666).
  - .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .3 Health Canada - Pest Management Regulatory Agency (PMRA)
  - .1 National Standard for Pesticide Education, Training and Certification in Canada (1995).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2                MEASUREMENT FOR PAYMENT**

- .1 No measurement for payment will be made under this Section. Work performed under this Section will be incidental to work in other related Sections.

**1.3                DEFINITION**

- .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

**1.4                QUALITY ASSURANCE**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**1.5                SCHEDULING**

- .1 Obtain approval Departmental Representative of schedule indicating beginning of Work.

**1.6                MAINTENANCE DURING WARRANTY PERIOD**

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.

- .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
- .2 Apply fertilizer in early spring at rate of 0.025 kg of nitrogen/m<sup>2</sup>.
- .3 Remove dead, broken or hazardous branches from plant material. Dispose of debris offsite.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Fill:
  - .1 Type (A): clean, natural river sand and gravel material, free from silt, clay, loam, friable or soluble materials and organic matter.
  - .2 Type (B): excavated soil, free from roots, rocks larger than 75 mm, building debris, and toxic ingredients (salt, oil, etc.). Excavated material shall be approved by Departmental Representative before use as fill.
- .2 Coarse washed stones: 35-75 mm diameter clean round hard stone.
- .3 Fertilizer:
  - .1 To Canada Fertilizer Act and Fertilizers Regulations.
  - .2 Complete, commercial, slow release with 35 % of nitrogen content in water-insoluble form.

## **Part 3 Execution**

### **3.1 IDENTIFICATION AND PROTECTION**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Identify plants and limits of root systems to be preserved as approved by Departmental Representative.
- .3 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.
- .4 Ensure no pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

### **3.2 TRENCHING AND TUNNELING FOR UNDERGROUND SERVICES**

- .1 Centre line location and limits of trench/tunnel excavation to be approved by Departmental Representative prior to excavation. Tunnel excavation to extend 2000 mm from edge of trunk on either side.



- .2 Excavate manually within zone of root system. Do not sever roots greater than 40 mm diameter except at greater than 500 mm below existing grade. Protect roots, and cut roots cleanly with sharp disinfected tools.
- .3 Excavate tunnel under centre of tree trunk using methods and equipment approved by Departmental Representative.
- .4 Minimum acceptable depth to top of tunnel: 1000 mm.
- .5 Backfill for tunnel and trench to 85% Standard Proctor Density. Avoid damage to trunk and roots of tree.
- .6 Complete tunnelling and backfilling at tree within 2 weeks of beginning Work.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 31 05 16 - Aggregate Materials.
- .2        Section 31 22 16.13 – Roadway Subgrade Reshaping.
- .3        Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .4        Section 32 11 23 – Aggregate Base Courses.

**1.2                MEASUREMENT PROCEDURES**

- .1        No measurement for payment will be made under this Section. Work performed under this Section will be incidental to work in other related Sections.

**1.3                REFERENCES**

- .1        American Society for Testing and Materials (ASTM)
  - .1        ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2        ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3        ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4        ASTM D422-63 (1998), Standard Test Method for Particle-Size Analysis of Soils.
  - .5        ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .6        ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .7        ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .8        ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2        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.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1        Divert unused granular material from landfill to local quarry as approved by Departmental Representative.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand to OPSS Granular B Type II specifications.
  - .2 Gradations to be within OPSS limits.

**Part 3 Execution**

**3.1 PLACING**

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .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 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative 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 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.
- .3 Equipped with device that records hours of actual work, not motor running hours.

- .4 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698 / ASTM D1557.
- .5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .6 Apply water as necessary during compaction to obtain specified density.
- .7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### **3.3 PROOF ROLLING**

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.
- .2 Obtain approval from Departmental Representative to use non-standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated. If non-standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
  - .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
  - .2 Backfill excavated subgrade with common material and compact in accordance with sub-base material and compact in accordance with this section.
  - .3 Replace sub-base material and compact.
- .6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

### **3.4 SITE TOLERANCES**

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

**3.5**

**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 Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                MEASUREMENT PROCEDURES**

- .1        No measurement for payment will be made under this Section. Work performed under this Section will be incidental to work in other related Sections.

**1.2                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.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Granular base material: to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1        Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material and other deleterious materials to OPSS Granular A specifications.
  - .2        Graduations within limits specified when tested.

**Part 3            Execution**

**3.1                SEQUENCE OF OPERATION**

- .1        Scarifying and reshaping:
  - .1        Scarify roadbed to width as indicated unless directed otherwise by Departmental Representative.
  - .2        Pulverize and break down scarified material to 40 mm maximum particle size.
  - .3        Blade and trim pulverized material to elevation and cross section dimensions as indicated unless directed otherwise by Departmental Representative.
  - .4        Where deficiency of material exists, add and blend in new granular base material as directed by Departmental Representative. Ensure no frozen material is used.
- .2        Compaction equipment:
  - .1        Compaction equipment capable of obtaining required material densities.
  - .2        Provide Departmental Representative with proof of equipment efficiency for unspecified equipment.
    - .1        Efficiency of proposed equipment equal to specified equipment.
    - .2        Obtain approval Departmental Representative before use.

- .3 Equip with device that records hours of actual work, not motor running hours.
  - .3 Compacting:
    - .1 Compact to density minimum 100 corrected maximum dry density in accordance with ASTM D698.
    - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
    - .3 Apply water as necessary during compaction to obtain specified density.
    - .4 Use mechanical tampers, approved by Departmental Representative to compact areas not accessible to rolling equipment to specified density.
  - .4 Repair of soft areas:
    - .1 Correct soft areas by removing defective material to depth and extent directed by Departmental Representative. Replace with material acceptable to Departmental Representative and compact to specified density.
    - .2 Maintain reshaped surface in condition conforming to this section until succeeding material is applied or until acceptance by Departmental Representative.
- 3.2 SITE TOLERANCES**
- .1 Reshaped compacted surface within plus or minus 10 mm of elevation as indicated.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1      Section 31 05 16 - Aggregate Materials.
- .2      Section 32 11 16.01 - Granular Sub-Base.
- .3      Section 32 11 17 – Reshaping Granular Roadbed.

**1.2                MEASUREMENT PROCEDURES**

- .1      Included in Balance of Project.

**1.3                REFERENCES**

- .1      American Society for Testing and Materials (ASTM)
  - .1      ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2      ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3      ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4      ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .5      ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .6      ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7      ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2      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.

**1.4                DELIVERY, STORAGE, AND HANDLING**

- .1      Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials.

**1.5                WASTE MANAGEMENT AND DISPOSAL**

- .1      Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

- .2 Divert unused granular material from landfill to local quarry as approved by Departmental Representative.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed stone or gravel to OPSS Granular A specifications.
  - .2 Gradations to be within OPSS limits.

## **Part 3 Execution**

### **3.1 SEQUENCE OF OPERATION**

- .1 Place granular base after sub-base surface is inspected and approved by Departmental Representative.
- .2 Placing
  - .1 Construct granular base to depth and grade in areas indicated.
  - .2 Ensure no frozen material is placed.
  - .3 Place material only on clean unfrozen surface, free from snow and ice.
  - .4 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
  - .5 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  - .6 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  - .7 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment
  - .1 Compaction equipment to be capable of obtaining required material densities.
- .4 Compacting
  - .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D698/D1557.
  - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
  - .3 Apply water as necessary during compacting to obtain specified density.
  - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

- .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

**3.2 SITE TOLERANCES**

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

**3.3 PROTECTION**

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 32 12 16.02 – Asphalt Paving for Building Sites.

**1.2                MEASUREMENT PROCEDURES**

- .1            No measurement for payment will be made under this Section. Work performed under this Section will be incidental to work in other related Sections.

**1.3                REFERENCES**

- .1            American Society for Testing and Materials International, (ASTM)
  - .1            ASTM D140-01, Standard Practice for Sampling Bituminous Materials.
- .2            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

**1.4                SUBMITTALS**

- .1            Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into Work, in accordance with ASTM D140.

**1.5                QUALITY ASSURANCE**

- .1            Upon request by Owner, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this section.

**1.6                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with ASTM D140.
- .2            Provide, maintain and restore asphalt storage area.

**1.7                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2            Divert unused asphalt from landfill to facility capable of recycling materials.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.

- .2 Water: clean, potable, free from foreign matter.

## **2.2 EQUIPMENT**

- .1 Pressure distributor to be:
  - .1 Designed, equipped, maintained and operated so that asphalt material can be:
    - .1 Maintained at even temperature.
    - .2 Applied uniformly on variable widths of surface up to 5 m.
    - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m<sup>2</sup> with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m<sup>2</sup>.
    - .4 Distributed in uniform spray without atomization at temperature required.
  - .2 Equipped with meter, registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
  - .3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
  - .4 Equipped with an easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
  - .5 Equipped with accurate volume measuring device or calibrated tank.
  - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
  - .7 Equipped with nozzle spray bar, with operational height adjustment.
  - .8 Cleaned if previously used with incompatible asphalt material.

## **Part 3 Execution**

### **3.1 APPLICATION**

- .1 Obtain Departmental Representative's approval of surface before applying asphalt tack coat.
- .2 Apply asphalt tack coat only on clean and dry surface.
- .3 Dilute asphalt emulsion with water at 1:1 ratio for application.
  - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
- .4 Apply asphalt tack coat evenly to pavement surface and do not to exceed 0.7 L/m<sup>2</sup>.
- .5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

- .6 Do not apply asphalt tack coat when air temperature is less than 10 degrees C or when rain is forecast within 2 hours of application.
- .7 Apply asphalt tack coat only on unfrozen surface.
- .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
- .10 Keep traffic off tacked areas until asphalt tack coat has set.
- .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
- .12 Permit asphalt tack coat to set before placing asphalt pavement.

**END OF SECTION**





**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 31 05 16 - Aggregate Materials.
- .2        Section 32 12 13.16 - Asphalt Tack Coats.

**1.2                MEASUREMENT PROCEDURES**

- .1        Included in Balance of Project.

**1.3                SUBMITTALS**

- .1        Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit asphalt concrete mix design to Departmental Representative for approval.
- .3        Materials to be tested by testing laboratory approved by Departmental Representative.
- .4        Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.
- .5        Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .6        Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.
- .7        Submit samples of following materials proposed for use at least 4 weeks prior to commencing work:
  - .1        One (1) 5 L container of asphalt cement.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Granular base and sub-base material: to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1        Crushed or screened stone, gravel or sand to OPSS Granular A and B Type II specifications.
  - .2        Gradations: within OPSS limits.
- .2        Mineral filler for asphalt concrete:
  - .1        Shall be according to OPSS 1003.
- .3        Asphalt cement: performance graded asphalt cement per OPSS 1101.

- .4 Asphalt prime: to CAN/CGSB-16.1, grade RM-20 CAN/CGSB-16.2, grade SS-1.
- .5 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.
- .6 Asphalt tack coat: to CAN/CGSB-16.2, grade SS-1.

## **2.2 EQUIPMENT**

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers for parking lots and driveways:
  - .1 Minimum drum diameter: 750 mm.
  - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
  - .1 Boxes with tight metal bottoms.
  - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
  - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .5 Suitable hand tools.

## **2.3 MIX DESIGN**

- .1 Mix design to OPSS 1151.04.02.
- .2 Job mix formula to be approved by Departmental Representative.
- .3 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be approved by Departmental Representative.

## **Part 3 Execution**

### **3.1 SUBGRADE SURFACE PREPARATION AND INSPECTION**

- .1 Verify grades of items set in paving area for conformity with elevations and sections before placing granular base and sub-base material.

- .2 Obtain approval of subgrade by Departmental Representative before placing granular sub-base and base.

### **3.2 GRANULAR SUB-BASE AND GRANULAR BASE**

- .1 Place granular base and sub-base material on clean unfrozen surface, free from snow and ice.
- .2 Place granular base and sub-base to compacted thicknesses as indicated. Do not place frozen material.
- .3 Place in layers not exceeding 150 mm compacted thickness. Compact to density not less than 98 % maximum dry density in accordance with ASTM D 698.
- .4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low.

### **3.3 ASPHALT PRIME**

- .1 Cutback asphalt:
  - .1 Heat asphalt prime for pumping and spraying in accordance with CAN/CGSB-16.1.
  - .2 Apply cutback asphalt prime to granular base, at rate directed by Departmental Representative, but do not exceed 2.2 L/m<sup>2</sup>.
  - .3 Apply on dry surface, unless otherwise directed by Departmental Representative.
- .2 Emulsified asphalt:
  - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.
  - .2 Apply diluted asphalt emulsion at rate directed by Departmental Representative but do not exceed 5 L/m<sup>2</sup>.
  - .3 Apply on damp surface unless otherwise directed by Departmental Representative.
- .3 Do not apply prime when air temperature is less than 5 degrees C or when rain is forecast within 2 hours.
- .4 If asphalt prime fails to set within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

### **3.4 ASPHALT TACK COAT**

- .1 In accordance with Section 32 12 13.16 – Asphalt Tack Coats.

### **3.5 PLANT AND MIXING REQUIREMENTS**

- .1 In accordance with ASTM D 995.

**3.6 ASPHALT CONCRETE PAVING**

- .1 Obtain approval from Departmental Representative before placing asphalt mix.
- .2 Place asphalt mix only when base or previous course is dry and air temperature is above 7 C.
- .3 Place asphalt concrete in compacted layers not exceeding 50 mm (one lift).
- .4 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .5 Compact parking lot and driveway asphalt concrete to required density. Roll until roller marks are eliminated.
- .6 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .7 Moisten roller wheels with water to prevent pick up of material.
- .8 Compact mix with hot tampers or other equipment approved by Departmental Representative, in areas inaccessible to roller.
- .9 Finish surface to be within 10 mm of design elevation and with no irregularities greater than 10 mm in 4.5 m.
- .10 Repair areas showing checking, rippling or segregation as directed by Departmental Representative.

**3.7 JOINTS**

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50 mm.

**3.8 TESTING**

- .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory in accordance with Section 01 45 00 - Quality Control.
- .2 Costs of tests will be paid under cash allowance.

**3.9**

**PROTECTION**

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 °C. Do not permit stationary loads on pavement until 24 hours after placement.
- .2 Provide access to buildings as required. Arrange paving schedule so as not to interfere with normal use of premises.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1    Section 03 30 00 – Cast-in-Place Concrete.
- .2    Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .3    Section 32 11 16.01 – Granular Sub-Base.
- .4    Section 32 11 23 – Aggregate Base Courses.
- .5    Section 31 05 16 – Aggregate Materials.

**1.2                REFERENCES**

- .1    American Society for Testing and Materials International (ASTM)
  - .1    ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2    ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3    ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
  - .4    ASTM D698-00ae1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2    Canadian General Standards Board (CGSB)
  - .1    CAN/CGSB-3.3-99 (March 2004), Kerosene, Amend. No. 1, National Standard of Canada.
  - .2    CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .3    Canadian Standards Association (CSA International)
  - .1    CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

**1.3                SUBMITTALS**

- .1    Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data: submit WHMIS MSDS sheets.
- .3    Inform Departmental Representative of proposed source of materials and provide access for sampling at least 4 weeks prior to commencing work.
- .4    If materials have been tested by accredited testing laboratory approved by Departmental Representative within previous 2 months and have passed tests equal to requirements of

this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Joint filler: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Granular base: material to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Type 1, 2 or 3 fill.
  - .2 Crushed stone or gravel.
  - .3 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
- .4 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .5 Fill material: to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Type 1, 2 or 3 fill.
  - .2 Crushed stone or gravel.
  - .3 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

## **Part 3 Execution**

### **3.1 GRADE PREPARATION**

- .1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials.
  - .1 Dispose of surplus and unsuitable excavated material off site.

### **3.2 GRANULAR BASE**

- .1 Obtain Departmental Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.



- .3 Compact granular base in maximum 150 mm layers to at least 95% of maximum density to ASTM D698.

### **3.3 CONCRETE**

- .1 Obtain Departmental Representative's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
- .4 Provide edging as indicated with 10 mm radius edging tool.
- .5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.

### **3.4 TOLERANCES**

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

### **3.5 EXPANSION AND CONTRACTION JOINTS**

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 2 m.
- .2 Install expansion joints at intervals of 6 m.
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

### **3.6 ISOLATION JOINTS**

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Seal isolation joints with sealant approved by Departmental Representative.

### **3.7 CURING**

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.

- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

### **3.8 BACKFILL**

- .1 Allow concrete to cure for 4 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative.
  - .1 Compact and shape to required contours as indicated.

### **3.9 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian General Standards Board (OGSB)
  - .1 CAN/CGSB-1.5-M91, Low Flash Petroleum Spirits Thinner.
  - .2 CGSB1-GP-74M-79, Paint, Traffic, Alkyd.
- .2 Green Seal Environmental Standards (GS)
  - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.

**1.2                SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Samples:
  - .1 Submit to Departmental Representative following material sample quantities at least 4 weeks prior to commencing work.
    - .1 Two 1 L samples of each type of paint.

**1.3                MEASUREMENT FOR PAYMENT**

- .1 Included in Balance of Project.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .2 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Paint:
  - .1 To MPI – EXT 2.1B, Alkyd zone/traffic marking.
  - .2 Paints: in accordance with MPI recommendation for surface conditions.
    - .1 Paints: maximum VOC limit 100 g/L to SCAQMD Rule 1113 to GS-11.
  - .3 Colour: to MPI listed, yellow and white.
  - .4 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.
- .2 Thinner: to MPI listed manufacturer.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
  - .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

### **3.2 EQUIPMENT REQUIREMENTS**

- .1 Paint applicator: approved pressure type with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

### **3.3 APPLICATION**

- .1 Pavement markings to be laid out by Contractor and verified by Departmental Representative.

- .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 °C, wind speed is less than 60 km/h and no rain is forecast within next 4h.
- .3 Apply traffic paint evenly at rate of 3m<sup>2</sup>/L.
- .4 Do not thin paint unless approved by Departmental Representative.
- .5 Symbols and letters to conform to dimensions indicated on existing conditions.
- .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.

### **3.4 TOLERANCE**

- .1 Paint markings to be within plus or minus 12mm of dimensions indicated on existing conditions.
- .2 Remove incorrect markings as directed by Departmental Representative.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 – 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 01 74 11 – Cleaning.

### **3.6 PROTECTION OF COMPLETED WORK**

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 32 92 23 – Sodding.

**1.2                MEASUREMENT PROCEDURES**

- .1            Included in Balance of Project.

**1.3                PAYMENT PROCEDURES**

- .1            Testing of topsoil: Departmental Representative will pay for cost of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

**1.4                REFERENCES**

- .1            Agriculture and Agri-Food Canada
  - .1            The Canadian System of Soil Classification, Third Edition, 1998.
- .2            Canadian Council of Ministers of the Environment
  - .1            PN1340-2005, Guidelines for Compost Quality.

**1.5                DEFINITIONS**

- .1            Compost:
  - .1            Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
  - .2            Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
  - .3            Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants.
  - .4            Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

**1.6                SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Quality control submittals:
  - .1            Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2.2 - SOURCE QUALITY CONTROL.

- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

## **1.7 QUALITY ASSURANCE**

- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

## **Part 2 Products**

### **2.1 TOPSOIL**

- .1 Topsoil for seeded areas: mixture of particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7% clay, and contain 2 to 10% organic matter by weight.
  - .2 Contain no toxic elements or growth inhibiting materials.
  - .3 Finished surface free from:
    - .1 Debris and stones over 50 mm diameter.
    - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
  - .4 Consistence: friable when moist.

### **2.2 SOURCE QUALITY CONTROL**

- .1 Advise Departmental Representative of sources of topsoil 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 testing laboratory designated by Departmental Representative.
  - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

## **Part 3 Execution**

### **3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with requirements of authorities having jurisdiction.



- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### **3.2 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as directed by Departmental Representative.
  - .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 2 m.
- .4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill as directed by Departmental Representative.
- .5 Protect stockpiles from contamination and compaction.

### **3.3 PREPARATION OF EXISTING GRADE**

- .1 Verify that grades are correct.
  - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
  - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
  - .2 Remove debris which protrudes more than 75 mm above surface.
  - .3 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
  - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### **3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.

- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil to following minimum depths after settlement.
  - .1 150 mm for seeded areas.
  - .2 135 mm for sodded areas.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

### **3.5 FINISH GRADING**

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
  - .1 Leave surfaces smooth, uniform and firm against deep foot printing.

### **3.6 ACCEPTANCE**

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

### **3.7 SURPLUS MATERIAL**

- .1 Dispose of materials except topsoil not required off site.

### **3.8 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3        Section 32 91 19.13 - Topsoil Placement and Grading.

**1.2                MEASUREMENT PROCEDURES**

- .1        Payment for sodding will be made at unit price bid of actual area surface measurements taken and computed by Departmental Representative for:
  - .1        Turf Grass Nursery Sod Type per square metre.
  - .2        Commercial Grade Turf Grass Nursery Sod per square metre.
- .2        There will be no measurement for payment of maintenance during the establishment period or warranty period.

**1.3                SUBMITTALS**

- .1        Samples.
  - .1        Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2        Obtain approval of samples by Departmental Representative.

**1.4                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.
- .3        Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

**1.5                SCHEDULING**

- .1        Schedule sod laying to coincide with preparation of soil surface.
- .2        Schedule sod installation when frost is not present in ground.

**1.6                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

- .2 Divert unused fertilizer from landfill to official hazardous material collections site.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
  - .1 Turf Grass Nursery Sod types:
    - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.
    - .2 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivars.
    - .3 Number One Named Cultivars: Nursery Sod grown from certified seed.
  - .2 Turf Grass Nursery Sod quality:
    - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
    - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
    - .3 Mowing height limit: 35 to 65 mm.
    - .4 Soil portion of sod: 6 to 15 mm in thickness.
- .2 Commercial Grade Turf Grass Nursery: sod that has not been grown as Turf Grass Nursery Sod crop.
  - .1 Mow sod at height directed by Departmental Representative within 36 hours prior to lifting, and remove clippings.
- .3 Sod establishment support:
  - .1 Geotextile fabric: biodegradable, 25 mm square mesh.
  - .2 Wooden pegs: 17 x 8 x 200 mm.
  - .3 Biodegradable starch pegs: 17 x 8 x 200 mm.
- .4 Water:
  - .1 Free of impurities that would inhibit growth.
- .5 Fertilizer:
  - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

- .2 Complete, synthetic, slow release with 65 % of nitrogen content in water-insoluble form.

## **2.2 SOURCE QUALITY CONTROL**

- .1 Obtain approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, and elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod and plus or minus 15 mm for Commercial Grade Turf Grass Nursery, surface to drain naturally.
- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

### **3.2 SOD PLACEMENT**

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

### **3.3 SOD PLACEMENT ON SLOPES AND PEGGING**

- .1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:

- .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
- .2 Not less than 3-6 pegs per square metre.
- .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
- .4 Drive pegs to 20 mm above soil surface of sod sections.

### **3.4 FERTILIZING PROGRAM**

- .1 Fertilizer shall be applied prior to application of sod.

### **3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Perform following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas as directed by Departmental Representative.
- .4 Maintain sodded areas weed free 95%.
- .5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles.

### **3.6 ACCEPTANCE**

- .1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
  - .1 Sodded areas are properly established.
  - .2 Sod is free of bare and dead spots.
  - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
  - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
- .2 Sodded Commercial Grade Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
  - .1 Sodded areas are properly established.
  - .2 Extent of surface soil visible when grass has been cut to height of 60 mm is acceptable.
  - .3 Sod is free of bare or dead spots and extent of weeds apparent in grass is acceptable.
  - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
  - .5 Fertilizing in accordance with fertilizer program has been carried out at least once.

- .3 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

### **3.7 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Water sodded Turf Grass Nursery Sod and Commercial Grade Turf Grass Nursery Sod areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
  - .2 Repair and re-sod dead or bare spots to satisfaction of Departmental Representative.
  - .3 Cut grass and remove clippings that will smother grass as directed by Departmental Representative to height as follows:
    - .1 Turf Grass Nursery Sod:
      - .1 50 mm during normal growing conditions.
    - .2 Commercial Grade Turf Grass Nursery Sod:
      - .1 60 mm during normal growing conditions.
    - .3 Cut grass at 2 week intervals or as directed by Departmental Representative, but at intervals so that approximately one third of growth is removed in single cut.
    - .4 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles.
    - .5 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

### **3.8 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**





- .1 General

## **1.2 RELATED SECTIONS**

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .3 Section 32 11 23 – Aggregate Base Courses.

## **1.3 MEASUREMENT PROCEDURES**

- .1 Included in Balance of Project.

## **1.4 REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM A48/A48M-03, Standard Specification for Gray Iron Castings.
  - .2 ASTM C478-08, Specification for Precast Reinforced Concrete Manhole Sections.
  - .3 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2 Ontario Provincial Standard Drawings (OPSD)
  - .1 OPSD 400.010 (November 2013 Rev. 2) – Cast Iron, Square Frame With Square Overflow Type Dished Grate For Catch Basins, Herring Bone Openings.
  - .2 OPSD 401.010 (November 2013 Rev. 3) – Cast Iron, Square Frame With Circular Closed Or Open Cover For Maintenance Holes.
  - .3 OPSD 701.010 (November 2014, Rev. 5) – Precast Concrete Maintenance Hole, 1200 mm Diameter.
  - .4 OPSD 704.010 (November 2014, Rev. 3) – Precast Concrete Adjustment Units For Maintenance Holes, Catch Basins, And Valve Chambers.
  - .5 OPSD 704.011 (November 2008, Rev. 1) – High Density Polyethylene Adjustment Units For Maintenance Holes, Catch Basins, And Valve Chambers.
  - .6 OPSD 705.010 (November 2014, Rev. 3) – Precast Concrete Catch Basin 600 x 600 mm.
  - .7 OPSD 708.020 (November 2011, Rev. 3) – Support For Pipe At Catch Basin or Maintenance Hole.
- .3 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 407 (November 2015) - Construction Specification For Maintenance Hole, Catch Basin, Ditch Inlet And Valve Chamber Installation.
  - .2 OPSS 1351 (November 2014) – Material Specification For Precast Reinforced Concrete Components For Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers.

- .3 OPSS 1853 (November 2007) – Material Specification For Rubber Adjustment Units For Maintenance Holes, Catch Basins, and Valve Chambers.
- .4 OPSS 1854 (November 2014) – Material Specification For High Density Polyethylene (HDPE) And Expanded Polystyrene (EPS) Adjustment Units For Maintenance Holes, Catch Basins, And Valve Chambers.

## **1.5 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - 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 two (2) copies WHMIS MSDS sheets.
- .3 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

## **1.6 QUALITY ASSURANCE**

- .1 Pre-Installation Meetings: convene pre-installation meeting one (1) week prior to beginning on-site installation, with contractor's representative and Departmental Representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building sub trades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Precast catch basins units to ASTM C478 and OPSD 705.010, complete with 600 mm deep sump. Precast catch basin maintenance hole units to ASTM C478 and OPSD 701.010.
  - .1 Adjusting rings: to ASTM C478 and OPSD 704.010 or 704.011.
  - .2 Frames, gratings, covers to dimensions as indicated and following requirements:
    - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
    - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
    - .3 Castings coated with two applications of asphalt varnish.
    - .4 Catch basin frames and covers to OPSD 400.010.
    - .5 Catch basin maintenance hole frames and covers to OPSD 401.010 Type 'B'.
  - .3 Components: to ASTM C478M and OPSS 1351.
- .2 Granular bedding: Granular base material in accordance with Section 32 11 23 – Aggregate Base Courses.

**Part 3 Execution**

**3.1 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing, catch basins or catch basin maintenance holes.

**3.2 INSTALLATION**

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade, in accordance with OPSS 407. Maximum relative difference between specified invert elevations not to exceed 10 mm.
- .2 Complete units as pipe laying progresses.
  - .1 Maximum of three units behind point of pipe laying will be allowed.
- .3 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% maximum density to ASTM D698.
- .4 Precast units:

- .1 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
- .2 Compact granular backfill to 95% maximum density to ASTM D698.
- .3 Place frame and cover on top section to elevation as indicated. If adjustment required use ring.
- .4 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
- .5 Refer to OPSD 708.020.

**END OF SECTION**

**Part 1 General****1.1 GENERAL**

- .1 The contractor shall provide all materials, equipment and labor necessary to install, test and place into service the pre-engineered fiberglass pump station as shown in the plans and described in this specification. The pre-engineered pump station package, including submersible pumps, pump control, fiberglass pump station, internal piping, accessories and auxiliary equipment shall be supplied by the pump manufacturer.

**1.2 REQUIREMENTS**

- .1 The pre-engineered fiberglass pump station package shall be capable of handling unscreened sewage, wastewater or stormwater in accordance with the design conditions defined in this specification and drawing package.
- .2 The fiberglass pump station shall have an integral, hopper-shaped pump station bottom, which is self-cleaning by virtue of its design. The flat surface area shall be minimized to an area that is directly influenced by the pump suction and shall be free of obstacles. The bottom surface area shall have a ratio of 1:4 as it relates to the cross-sectional area of the pump station. The sloping walls of the pump station bottom shall further optimize the self-cleaning features of this station by directing all solids, trash and sludge, normally found in sewage and wastewater, to the suction of the submersible pumps to facilitate removal and effectively clean the bottom.
- .3 Furnish and install 2 submersible non-clog wastewater pump(s). Each pump shall be equipped with submersible electric motor, connected for operation on a 600 volt, 3 phase, 60 hertz, three-wire service, with 16 meters of submersible cable (SUBCAB), suitable for submersible pump applications. The power cable shall be sized according to CEC and CSA standards. The pump shall be supplied with a mating cast iron 50mm discharge connection and be capable of delivering 2.5l/s at 9.0m TDH. Shut off head shall be 0.6m (minimum). Each pump shall be fitted with necessary lifting chain or stainless steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

**Part 2 Products****2.1 PUMPS**

- .1 Pump Design
  - .1 The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two (stainless steel, galvanizes steel) guide pipes extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

.2 Pump Construction

- .1 Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.
- .2 Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.
- .3 Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

.3 Cable Entry Seal

- .1 The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by stainless steel washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. **The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.**

.4 Motor

- .1 The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with

- threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.
- .2 The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.
  - .3 The power cable shall be sized according to the CEC and CSA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.
  - .4 The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.
- .5 Motor Cooling System
- .1 (Pumps with motors up to 10-hp) Motors are sufficiently convection-cooled by the surrounding environment or pumped media.
  - .2 (Pumps with motors of 12-hp and greater) Motors shall be equipped with an integral motor cooling jacket of either an open type or closed-loop type.
- .6 Bearings
- .1 The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. **Single row lower bearings are not acceptable.**
- .7 Mechanical Seal
- .1 Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating corrosion resistant, **tungsten-carbide** ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating corrosion resistant, **tungsten-carbide** seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor **depend on direction of rotation for sealing**. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For unique applications, other seal face materials shall be available.
  - .2 **The following seal types shall not be considered acceptable nor equal to the dual independent seal specified:** shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common

- single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.
- .3 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. **The motor shall be able to operate non-submerged without damage while pumping under load.**
- .8 Seal lubricant shall be non-toxic and FDA Approved.
- .9 Pump Shaft
- .1 Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T.
- .2 The use of stainless steel sleeves will not be considered equal to stainless steel shafts as shaft sleeves only protect the shaft around the lower mechanical seal.
- .10 Pump Impeller / Volute for C – type Pumps
- .1 The impeller(s) shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency; thus, reducing operating costs. Impeller(s) shall be keyed to the shaft, retained with an Allen head bolt and shall be capable of passing a minimum 19 mm diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.
- .2 A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring insert that is drive fitted to the volute inlet.
- .3 Pump volute(s) shall be single-piece grey cast iron, Class 35B, non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.
- .11 Pump Impeller / Volute for N – type Pumps
- .1 The impeller(s) shall be of (gray cast iron, Class 35B / high chrome iron), dynamically balanced, semi-open, multi-vane, back-swept, non-clog design. The impeller vane leading edges shall be mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction which shall keep them clear of debris, maintaining an unobstructed leading edge. The impeller(s) vanes shall have screw-shaped leading edges. The leading edges of the cast iron impellers shall be hardened to Rc 45. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in waste water. The screw shape of the impeller inlet shall provide an inducing effect for the handling of sludge and rag-laden wastewater. Impellers shall be locked to the shaft, held by an impeller bolt and treated with a corrosion inhibitor.



- .2 The pump volute shall be of A48 Class 35B gray cast iron and shall have a (cast iron / high chrome iron) replaceable ring having spiral shaped cast groove(s) at the suction of the volute. The internal insert ring shall provide effective sealing between the pump volute and the multi-vane, semi-open impeller. The sharp spiral groove(s) shall provide the shearing edge(s) across which each impeller vane leading edge shall cross during its rotation in order to remain unobstructed. The clearance between the internal volute bottom and the impeller leading edges shall be adjustable.
- .12 Sump Mixing Valve
- .1 One pump unit in each pump station shall be equipped with an automatically operating Flygt Mix-flush Valve mounted directly to a machined boss located on the exterior of the pump volute casting that will provide mixing action within the sump at the start of the pumping cycle. The valve shall redirect a portion of the pumped media into the sump to re-suspend solids and grease by the turbulent action of its discharge.
  - .2 The valve shall be equipped with an adjustable, wear-resistant discharge nozzle that can be used to direct flow within the sump. The valve shall operate by differential pressure across the valve and shall not require any electric or pneumatic power source to operate. The valve shall be suitable for use in Class I, Division 1 hazardous locations.
  - .3 The valve shall open at the beginning of each pumping cycle and shall automatically close during the pump operation after a pre-set time. A method of adjusting the valve operating time shall be provided.
- .13 Motor Protection
- .1 All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.
  - .2 A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. **USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED.**
  - .3 The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS monitoring unit shall be designed to be mounted in any control panel.

## **2.2 PRE-ENGINEERED FIBERGLASS PUMP STATION CONSTRUCTION**

- .1 The station cylinder shall be wound to the station bottom such that the assembly is of a monolithic design, which is capable of withstanding the full hydrostatic head from the exterior of the station while the station is completely empty.
- .2 The cylinder shall be made of FRP using the filament winding process. A safety factor of two (2) on the minimum ultimate tensile strength of the laminate bottom shall be used in designing the basin and cylinder wall thicknesses for the station, taking into account all normally imposed loads arising from floatation, soil pressures, normal backfill, handling

loads, operating loads and static loads imposed by equipment used in hoisting the pumps in and out of the station.

- .3 The cylinder is a filament wound laminate constructed by saturating continuous strand glass roving in a controlled pattern over a corrosion resistant white-pigmented resin layer that is to be 8 mils minimum thickness. The roving's shall be applied uniformly throughout the entire length of the cylinder as required to provide adequate thickness for the mechanical loads of each application. The winding pattern shall be a combination of helical and hoop wraps and shall produce a dense laminate without non-reinforced resin pockets or air bridging between the rovings. The glass content of the structural laminate shall be 60% to 70% by weight.
- .4 The station bottom is a 30% to 50% glass content, chop spray laminate, constructed by built-up layers of chop spray and chopped strand mat applied along with a catalyzed resin. Each layer shall be properly wetted out and rolled out so that it is free of air voids until the required wall thickness has been obtained.
- .5 All inside surfaces shall be smooth and free of cracks and crazing. The inside surface will be pigmented or gel coated to a bright white finish. All surfaces other than those made in contact with the mold surface shall be coated with air-inhibited resin or gelcoat, this includes any cut edges of laminate.
- .6 The station shall be provided with one (1) anti-flotation flange located near the bottom of the station. This anti-flotation flange is an integral part of the station and is sufficient in design to withstand the forces acting upon the station due to the subsoil water pressure. Once the station is inserted into the hole, concrete ballast may be required depending on the station depth, please refer to the recommendations for concrete ballast as recommended.
- .7 The combination of the flange and the loading of backfill material over the concrete shall provide adequate ballast against buoyancy under full hydrostatic head conditions.

## 2.3

### STATION COVER

- .1 The station cover shall be of 1/4-inch thick Type-5086 aluminum diamond plate with an integral Safe-Hatch access cover. All bars, angles and shapes shall be type 6061-T6 aluminum. The access cover frame shall be a minimum of 4-inches deep and shall be adequately sized to allow for easy passage of the submersible pumps. The Safe-Hatch access cover shall be designed to support the weight of the pump unit plus pedestrian traffic. The access door(s) shall be equipped with a hold-open arm, held open in the 90-degree position. Cover door hinges shall be heavy-duty design and be cast 1/4-inch thick Type 316 stainless steel with 3/8-inch diameter stainless steel hinge pins. All fasteners shall be type-316 stainless steel. Each hatch shall be supplied with a type-316 stainless steel slam lock, having a key-way protected by a threaded plug. The plug shall be flush with the diamond plate cover. The hatch shall be equipped with an aluminum lift handle that shall be flush to the top of the diamond plate cover.
- .2 The access cover unit shall be equipped with a Safe-Hatch hinged safety grate to provide protection against fall-through and to control access into the confined space. Grate openings shall be sized to allow for routine maintenance inspection without having to open the safety grate. The closed safety grate shall be designed to support the weight of one pump to facilitate site pump wash-down and inspection. The hatch opening will have a 4" elevated toe board to prevent tools from being kicked into the wet well (per OSHA 1926.502 (j)).

## **2.4 ELECTRIC CONTROLS**

### **.1 Enclosure and Level Control**

- .1 The pre-engineered fiberglass pump station shall be furnished with pre-installed conduit fittings for connection of the pump power/control and level control wiring. Pump station liquid level control shall be as per options listed below. A stainless steel mounting bracket and a 2" electrical conduit fitting shall be included. All electrical and control accessories shall be shipped inside of the pump station for field installation.

### **.2 Pump Control Panel**

- .1 The package pump station shall be furnished with an automatic pump control system housed in a NEMA Type-3 Steel enclosure. The control system shall include the following features:
  - .1 NEMA 3 rated steel enclosure with aluminum inner door and padlock hasp
  - .2 IEC rated motor starters
  - .3 Hand / Off / Auto selector switch for each pump
  - .4 Main incoming power circuit breaker
  - .5 Individual pump circuit breakers
  - .6 Duplex pump station microprocessor based pump controller.
  - .7 Float switches for level sensing (3)
  - .8 Thermal & seal protection
  - .9 2Kva control power transformer
  - .10 Phase monitor
  - .11 Alarm light (red dome light style)
  - .12 Solid state reduced voltage starting
  - .13 Horn or bell audible alarm with silence pushbutton
  - .14 Run time meters, one per pump
  - .15 Intrinsic safety
  - .16 12" X 10" space reserved for telemetry
- .2 Suppliers such as John Brooks Company Limited, may assist in providing design and shop drawings for pump station.

## **Part 3 Execution**

### **3.1 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing pre-manufactured pump station.

### 3.2 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade, in accordance with OPSS 407. Maximum relative difference between specified invert elevations not to exceed 10 mm.
- .2 Install station as per Manufacturers recommendation.

### 3.3 TESTING

- .1 Standard Pump Factory Test
  - .1 Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer's plant prior to shipment:
    - .1 Minimum 3-point hydraulic performance test
    - .2 No-Leak seal integrity test
    - .3 Electrical integrity test
  - .2 Optional Pump Factory Test
    - .1 Each completed and assembled pump/motor unit shall be performance tested at the manufacturer's plant prior to shipment. The results of the hydraulic performance test shall be within the limits set forth by the Hydraulic Institute. Certified curves shall be submitted to the owner or his design engineer for approval prior to shipment.
    - .2 As a minimum, each finished pump shall be performance tested for total dynamic head, capacity, efficiency and power requirements at six (6) operating points plus shut-off head for the selected impeller diameter, of which, the design capacity operating point shall be included.
- .3 Field Start-up
  - .1 After installation, a pump station start-up shall be performed by the installing contractor under the supervision of the manufacture's authorized representative. One (1) day of field service shall be provided by an authorized, factory trained representative of the pump manufacturer. Services shall include, but not be limited to, inspection of the completed pump station installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, supervision of all field-testing and activation of the Pump Manufacturer's Warranty. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

### 3.4 WARRANTY

- .1 Station Warranty
  - .1 The Pump Manufacturer shall Warrant to the Owner the pre-engineered fiberglass pump station components against defects in material and workmanship for a period of one (1) year from date of start-up or 18 months from date of shipment, whichever is sooner. This warranty shall cover the cost of labor and

materials, excluding removal and reinstallation costs, required to correct any warrantable defect, FOB, Manufacturer's authorized warranty service location.

.2 Pump & Control Warranty

.1 Manufacturer's standard warranty covers the pump and control system.

**END OF SECTION**



**Part 1 General****1.1 GENERAL**

- .1 The contractor shall provide all materials, equipment and labor necessary to install, test and place into service the Containerized Suspended Solids Removal System as shown in the plans and described in this specification. The Containerized Suspended Solids Removal System, including all accessories and auxiliary equipment shall be supplied by the manufacturer.
- .2 Suppliers such as Filterboxx, may assist in providing design and shop drawings sewage treatment unit.

**1.2 REQUIREMENTS**

- .1 The goal of this process is to ensure optimal removal of elemental mercury, TSS, and biological solids. The system is to be designed with four stages of solids separation. The treatment train is to be a 45m<sup>3</sup>/day suspended solids and biological solids treatment process consists of Primary Settling, Aeration, Clarification, and a Micro-strainer. A more detailed description of the process is described below.
- .2 Influent wastewater is pumped from the pump station, see Section 33 05 15, directly into the plant, where it immediately enters the Primary Settling tank. The Primary Settling tank removes coarse solids from the system and helps to protect downstream mechanical equipment while helping to prevent the accumulation of floatable and inorganic materials in the Aeration Tank. The solids settled in the Primary Settling Tank are removed regularly using a vacuum truck.
- .3 Supernatant from the Primary Settling Tank flows by gravity into the Aeration Tank. A chemical addition system is too be included in the event that it is later established that coagulant or polymer is necessary to help facilitate greater suspended solids separation. Chemical will be added directly into the Aeration tank using a chemical dosing pump.
- .4 Wastewater shall flow by gravity from the Aeration Tank to the Clarifier, to provide a secondary clarification/settling step in the treatment process.
- .5 Clear supernatant water from the Clarifier flows by gravity to a rotary drum Micro-strainer for final effluent polishing to remove any last residual suspended solids prior to discharge. The rotary drum Micro-strainer shall utilize a 28 µm mesh screen to strain out any residual suspended solids carried over from the Clarifier. This provides an additional measure of process integrity in the event of a process upset condition. Effluent flows by gravity from the micro-strainer into the sewer drain.
- .6 The overall process shall be controlled by a Programmable Logic Controller (PLC). The PLC receives inputs from flow, level, and process control monitoring equipment and controls the blower and valves based on the information received and interpreted.
- .7 The entire system and controls shall be installed within an Engineered modular building. The Engineered building is insulated, heated, ventilated, and includes appropriate lighting.
- .8 Engineered building, exterior colour to match (or close to) the colour of the new backup generator located on site.

- .1 Colour : Tiger Drylac Powder Coatings ral colors: RAL 7032.

## **Part 2 Products**

### **2.1 SETTLING TANK**

- .1 Aluminum construction (aluminum grade 5052, 5083, or 5086).  
.2 Open-topped rectangular construction.  
.3 Volume: 8 m<sup>3</sup>.  
.4 1829 mm L x 2134 mm W x 2134 mm H.  
.5 Drain connection: 3" flanged connection with manual butterfly valve and camlock truck-out connection.

### **2.2 AERATION TANK**

- .1 Aluminum construction (aluminum grade 5052, 5083, or 5086).  
.2 Open-topped rectangular construction.  
.3 Aeration system including EDI FlexAir fine bubble diffusers, FPZ MD-series regenerative blower, Sch. 40 stainless steel piping (above the tank operating level), and Sch. 80 CPVC piping (below the tank operating level).  
.4 Volume: 8 m<sup>3</sup>.  
.5 1829 mm L x 2134 mm W x 2134 mm H.  
.6 Drain connection: 3" flanged connection with manual butterfly valve and camlock truck-out connection.

### **2.3 CLARIFIER**

- .1 Aluminum Construction (aluminum grade 5052, 5083, or 5086).  
.2 Open-topped conical construction.  
.3 Volume: 3 m<sup>3</sup>.  
.4 Cone slope.  
.5 1676 mm top diameter (1422 mm bottom diameter) x 1524 mm overall height.  
.6 Drain connection: 3" flanged connection with manual butterfly valve and camlock truck-out connection.  
.7 Scum rake: SEW-Eurodrive, type RF37A.

### **2.4 MICRO-STRAINER**

- .1 Rotary drum type strainer.  
.2 28 µm mesh screen.

### **2.5 PIPING**

- .1 Process piping Schedule 80 PVC.



- .2 Air header piping 304 SS.

## 2.6 CONTROL PANEL

- .1 Schneider Modicon PLC.
- .2 C-More EA9-series colour touch-screen HMI.

## 2.7 BUILDING

- .1 Dimensions
  - .1 45'L x 10'W x 9'8"H.
- .2 Materials
  - .1 All materials shall be made of ASTM A36 carbon steel.
- .3 Tolerances
  - .1 Linear dimensions shall be  $\pm 3$ mm and shall not be cumulative.
- .4 Welding
  - .1 Welding materials and procedures shall be in accordance with CAN/CSA W59 and done by a welding shop certified to CAN/CSA W47.1.
  - .2 Items shall be fabricated with all joints tightly fitted and secured.
  - .3 Floor plate shall be seal welded on all sides and seams including between floor plates, between floor and wall panels, and between floor plate and end beams.
  - .4 Floor reinforcements shall be stitch welded to floor plate.
  - .5 All building modifications penetrating the building walls shall be seal welded.
  - .6 Exposed joints shall be ground flush and smooth with adjacent finished surface.
  - .7 Exposed edges and outside corners of materials shall be ground down smooth.
- .5 Interior Framing
  - .1 Interior walls and roof of building shall be framed with appropriate sized metal channels. Studs shall be framed as close to existing building walls as possible, leaving maximum interior space available.
- .6 Insulation
  - .1 Insulation on interior walls shall be 75mm Roxul insulation (R12).
  - .2 Insulation on interior roof shall be 125mm Roxul insulation (R20).
  - .3 Insulation on bottom of skid shall be 75mm Polyurethane spray foam (R20).
- .7 Cladding
  - .1 Interior cladding shall be minimum 26ga corrugated metal sheeting/paneling, 3mm corrugation preferred, maximum 6mm.
  - .2 Interior cladding color shall be white or approved equivalent color.
  - .3 Vapor barrier shall be installed between insulation and cladding.
- .8 Man Doors
  - .1 Man doors shall be 914mm wide x 2133mm high, insulated steel doors with weather stripping and spring fitted door chain retainer.

- .2 Man doors shall include 610mm x 610mm thermal pane window.
- .3 Man doors shall be lockable and shall be fitted with exterior thumb latch and interior panic bar.
- .9 End Doors
  - .1 Building shall have double doors on both ends unless noted otherwise (i.e.: Full height & full width building type doors).
- .10 Flooring
  - .1 Interior flooring shall be 6mm ASTM A36 carbon steel flat plate and shall span the entire width of the building.
- .11 Surface Preparation
  - .1 All surfaces to be primed or painted shall have surface prepared before application of primer or paint.
  - .2 Surface finish to be determined based on coating manufacturer recommendations. If not specified by the coating manufacturer the blast shall be to SSPC-SP6.
- .12 Painting
  - .1 Primer shall be applied to internal walls prior to framing and insulating.
  - .2 Floor plate shall be primed and painted grey or approved equivalent color.
  - .3 Floor shall include non-slip additive over entire surface, unless noted otherwise.
  - .4 Floor paint type shall be a high durability industrial epoxy. Epoxy manufacturer and type to be recommended by Fabricator and shall be approved by FilterBoxx. Paint shall be applied according to Manufacturers recommendations on quality control activities, dry film thickness, method of application, curing times, and curing temperatures.
  - .5 Exterior of building shall be painted white or approved equivalent color.
  - .6 Exterior paint type shall be recommended by Fabricator. Coating manufacturer and type to be recommended by Fabricator and shall be approved by FilterBoxx. Paint shall be applied according to Manufacturers recommendations on quality control activities, dry film thickness, method of application, curing times, and curing temperatures.

## **2.8 LIGHTING**

- .1 Internal: Ten (10) 4' fluorescent fixtures.
- .2 External: Light fixture mounted above man door.
- .3 Emergency lighting in plant.

## **2.9 HEATING & VENTILATION**

- .1 Heating: 1 x 10 KW, 30amp, 3 phase, 208 V, Ruffneck.
- .2 Ventilation: 1 x 10" air intake, 1x12" exhaust fan.

## **2.10 SYSTEM ELECTRICAL AND INSTRUMENTATION**

- .1 UL and CSA approved.

- .2 208 VAC/3 Phase/ 60 hz.
- .3 NEMA 4 rating for all electrical items.

### **2.11 TIE IN CONNECTIONS**

- .1 Influent – 3x 2” Male Camlocks.
- .2 Effluent – 1x 2” Male Camlock.
- .3 Sludge – Vacuum out of primary settling tank and aeration tank = 3” Male Camlock.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade, in accordance with OPSS 407. Maximum relative difference between specified invert elevations not to exceed 10 mm.
- .2 Install treatment unit directly onto cast-in-place concrete slab and as per Manufacturers recommendation.
- .3 Complete all appropriate connection, inlet, outlet, electrical, etc., in order to make unit operational.

### **3.2 TESTING**

- .1 Standard Pump Factory Test
  - .1 Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer’s plant prior to shipment:
    - .1 Minimum 3-point hydraulic performance test.
    - .2 No-Leak seal integrity test.
    - .3 Electrical integrity test.
  - .2 Field Start-up
    - .1 After installation, a pump station start-up shall be performed by the installing contractor under the supervision of the manufacture’s authorized representative. 1 days of field service shall be provided by an authorized, factory trained representative of the pump manufacturer. Services shall include, but not be limited to, inspection of the completed pump station installation to ensure that it has been performed in accordance with the manufacturer’s instructions and recommendations, supervision of all field-testing and activation of the Pump Manufacturer’s Warranty. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly without exceeding the full load amperage rating of the motor. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

### **3.3 WARRANTY**

- .1 Station Warranty

- .1 The Pump Manufacturer shall Warrant to the Owner the treatment unit components against defects in material and workmanship for a period of 1 year from date of start-up or 18 months from date of shipment, whichever is sooner. This warranty shall cover the cost of labor and materials, excluding removal and reinstallation costs, required to correct any warrantable defect, FOB, Manufacturer's authorized warranty service location.
- .2 Pump & Control Warranty
  - .1 Manufacturer's standard warranty covers the pump and control system.
- .3 Operations Manual
  - .1 Manufacturer to provide three (3) copies of the operation and maintenance manual in hard copy and one (1) electronic version.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 03 30 00 - Cast-in-Place Concrete.
- .3        Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .4        Section 32 11 16.01 – Granular Sub-Base.
- .5        Section 32 11 23 – Aggregate Base Courses.
- .6        Section 33 41 00 – Storm Utility Drains.

**1.2                MEASUREMENT PROCEDURES**

- .1        Included in Balance of Project.

**1.3                REFERENCES**

- .1        American National Standards Institute/American Water Works Association  
(ANSI/AWWA)
  - .1        ANSI/AWWA C104/A21.4-95, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - .2        ANSI/AWWA C111/A21.11-00, Rubber-Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.
  - .3        ANSI/AWWA C110/A21.10-98, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75 mm through 1200 mm), for Water.
  - .4        ANSI/AWWA C150/A21.50-02, Thickness Design of Ductile-Iron Pipe.
  - .5        ANSI/AWWA C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - .6        ANSI/AWWA C153/A21.53-00, Ductile-Iron Compact Fittings for Water Service.
  - .7        ANSI/AWWA C502-94, Dry-Barrel Fire Hydrants.
  - .8        ANSI/AWWA C504-00, Rubber-Seated Butterfly Valves.
  - .9        ANSI/AWWA C504-94, Resilient-Seated Gate Valves for Water Supply Services.
  - .10       ANSI/AWWA C550-90, Protective Epoxy Interior Coatings for Valves and Hydrants.
  - .11       ANSI/AWWA C600-99, Installation of Ductile-Iron Water Mains, and Their Appurtenances.
  - .12       ANSI/AWWA C800-01, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).

- .13 ANSI/AWWA C900-97, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
- .2 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
  - .2 ASTM A307-02, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
  - .3 ASTM B88M-99, Standard Specification for Seamless Copper Water Tube Metric.
  - .4 ASTM C478M-97, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
  - .5 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m<sup>3</sup>)).
  - .6 ASTM F714-13, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .3 American Water Works Association (AWWA)/Manual of Practice
  - .1 AWWA M17-1989, Installation, Field Testing, and Maintenance of Fire Hydrants.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
  - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA B137 Series-02, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
    - .1 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
- .6 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S520-1991, Hydrants.
  - .2 CAN4-S543-1984, Internal-Lug, Quick Connect Couplings for Fire Hose.
- .7 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 1351 (November 2014) Material Specification for Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers.
- .8 National Fire Protection Association (NFPA)
  - .1 NFPA 291 (2010): Recommended Practice for Fire Flow Testing and Marking of Hydrants.

#### **1.4 STANDARDS**

- .1 All water main materials and workmanship to be in accordance with City of Ottawa Standards. W refers to City of Ottawa Standard drawings.

#### **1.5 MATERIAL CERTIFICATION**

- .1 Submit manufacturer's certification that pipe materials meet requirements of this section at least 1 week prior to commencing work. Include manufacturer's drawings, information and shop drawings where pertinent.

#### **1.6 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Provide shop drawings for the following:
  - .1 Valve boxes
- .3 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .4 Provide product data for the following:
  - .1 Pipe
  - .2 Fittings
  - .3 Hydrants
  - .4 Valves
  - .5 Valve Boxes
  - .6 Retaining and restraining rings and associated hardware

#### **1.7 CLOSEOUT SUBMITTALS**

- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 78 00 - Closeout Submittals.
  - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

#### **1.8 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Water service to building must not be interrupted.
- .3 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.
- .4 Notify Departmental Representative minimum of 72 h in advance of interruption in service.

- .5 Do not interrupt water service for more than 3 h and confine this period between 18:00 and 07:00 h local time unless otherwise authorized by Departmental Representative.
- .6 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .7 Provide "Out of Service" sign on hydrant not in use.

## **Part 2 Products**

### **2.1 PIPE**

- .1 For Open Cut Installation:
  - .1 Polyvinyl chloride pressure pipe: to CSA B137.3 and AWWA C900 for pipe sizes 305 mm diameter and less and to AWWA C-905 for 406 mm diameter pipe, pressure class 150, DR 18, 1 MPa, cast iron outside diameter, blue in color and supplied with gaskets.
    - .1 Approved for use by the City of Ottawa.
  - .2 Push-on joints as per AWWA C-111, complete with vulcanized synthetic rubber gaskets.

### **2.2 FITTINGS**

- .1 Fittings:
  - .1 Short body ductile iron fittings: to AWWA C153.
    - .1 Cement lined per AWWA C-104.
    - .2 Mechanical or push-on joint.
  - .2 PVC fittings to AWWA C907 and CSA B137.3.
    - .1 Push-on joints.

### **2.3 RESTRAINING AND RETAINING RINGS**

- .1 For use on PVC pipe:
  - .1 The restraining devices shall meet the minimum requirements of ASTM F1674, have a working pressure of 1035 kPa complete with minimum 2:1 safety factor.
  - .2 Retaining rings are to be designed for use with their respective pipe and fitting size and class. The restraint mechanism shall incorporate a series of machined serrations on the inside diameter of the clamping ring.
    - .1 The rings are to be manufactured from high quality ductile iron per ASTM A536, Grade 65-45-12.
    - .2 T-bolts, clamping bolts and nuts, type 304 stainless steel per ASTM F593.
    - .3 Approved for use by the City of Ottawa.



## 2.4 COUPLINGS

- .1 Couplings designed to withstand a hydrostatic test pressure of 1035 kPa.
  - .1 Center Sleeve:
    - .1 Material:
      - .1 Steel sleeves – carbon steel as per ASTM A36/A53/A512, minimum yield strength of 207 MPa.
      - .2 Cast sleeves – ductile iron as per ASTM A536, grade 64-45-12.
      - .3 Finish: shop finish enamelled.
      - .4 Ends to be smooth inside surface for uniform gasket seating.
        - .1 Minimum lengths:
          - .1 203 mm pipe and smaller: 152 mm.
          - .2 305 mm pipe: 203 mm.
          - .3 406 mm pipe: 228 mm.
        - .2 End Rings: ductile iron to ASTM A536.
        - .3 Nuts and Bolts: type 304 stainless steel per ANSI/AWWA C-111/A21.115, 25 mm diameter.
        - .4 Gasket: grade 30 special compound rubber (SBR) recommended for water, salt solution, mild acids and bases with a temperature range between -40°C to +65°C.
        - .5 Approved for use by City of Ottawa Standards.

## 2.5 VALVES

- .1 Valves to open clockwise.
- .2 Gate valves to ANSI/AWWA C509, resilient seated:
  - .1 Application – for use on all 152mm and 305 mm diameter water main.
  - .2 Material:
    - .1 Cast iron to ASTM A126, class B narrow body design.
    - .2 Ductile iron to ASTM A536, short body design.
  - .3 Non-rising stem, complete with 50 mm square operating nut in the vertical position, standard O-ring type steam seal.
  - .4 Pressure rating – minimum 1380 kPa.
  - .5 Finish: two part spray epoxy coating or a fusion bonded epoxy coating, factory applied to exterior and interior surfaces in accordance with ANSI/AWWA C550.
  - .6 Joints:
    - .1 For Polyethylene pipe:
      - .1 Flanged joint ends to ANSI/AWWA C110/A21.10.
      - .2 Valve flanges to be flat faced, parallel and concentric.
    - .2 For PVC or FPVC pipe:

- .1 Mechanical joint ends to ANSI/AWWA C111/A21.11, complete with cast iron gland rings, stainless steel nuts and bolts, Type 304 or 316, and gasket.

## 2.6 VALVE BOXES

- .1 Cast iron valve boxes: 130 mm screw type manufactured from good quality grey iron to City of Ottawa Standards.
- .2 Valve boxes to consist of six elements – base, bottom section, extension, top section, cap and guide wheel, in accordance with City of Ottawa standard drawing number W-24.

## 2.7 VALVE CHAMBERS

- .1 Gate Valve Chamber
  - .1 Precast reinforced concrete, components in accordance with OPSS 131 and ASTM C478M, and the following City of Ottawa standard drawings:
    - .1 Base section to W-5.
    - .2 Chamber section to W-6.
    - .3 Adjustment units to W-9.
    - .4 Circular Chamber to W-3.
    - .5 Top section to W-8.
  - .2 Backflow Preventer Valve Chamber
    - .1 Precast reinforced concrete, components in accordance with OPSS 131 and ASTM C478M.
    - .2 Modified R-2 chamber in accordance with City of Ottawa standard drawings W-10, W-14, W-14.1, complete with precast chimney as detailed in OPSD 1101.015.
- .3 Cast ladder rungs integral with unit; field installation not permitted.
- .4 Frame and cover:
  - .1 Manufactured from good quality grey iron and shall be solid with clean surfaces, free from scales, lumps, flaws, blow holes, or other defects. No plugging or filling of defects or other methods of correcting defects shall be permitted.
  - .2 Castings shall be in accordance with ASTM A 48M, Class No. 30B.
  - .3 Cover to be marked "WATER".
  - .4 Castings to be thoroughly coated with approved casting paint.
  - .5 Gate Valve Chamber:
    - .1 Castings to conform to dimensions of W-15 and W-16.
  - .6 Backflow Preventer Valve Chamber:
    - .1 Castings to conform to dimensions of OPSD 402.030.

## 2.8 BALL VALVES

- .1 Ball valves for use on test tees:

- .1 Bod and cap: cast high tensile bronze to ASTM B 62.
- .2 Pressure rating: Class 125, 860 kPa steam, WP = 1.4 MPa WOG.
- .3 Connections: Screwed ends to ANSI B1.20.1 and with hex shoulders.
- .4 Stem: tamperproof ball drive.
- .5 Stem packing nut: external to body.
- .6 Ball and seat: replaceable hard chrome solid ball and Teflon seats.
- .7 Stem seal: TFE with external packing nut.
- .8 Operator: removable lever handle.

## 2.9 HYDRANTS

- .1 Post type hydrants: dry barrel, compression, open against pressure, dry top, three way type with two 64 mm hose outlet nozzles and one 127 mm pumper outlet nozzle.
- .2 Hydrants, to CAN/ULC-S520, ANSI/AWWA C502, and approved for use by City of Ottawa.
- .3 Designed for a minimum working pressure of 1035 kPa.
- .4 The upper and lower barrels shall be ductile iron complete with breakable flange and breakable bolts.
- .5 Main valve: nominal diameter valve opening shall be a minimum of 127 mm.
- .6 Drain valve: the hydrant is to be provided with a drain valve that closes as the main valve opens.
- .7 Inlet connection to be mechanical joint, 152 mm bell at base of hydrant to ANSI/AWWA C111/A21.11, complete with cast iron gland rings, stainless steel nuts and bolts, Type 304 or 316, and gaskets. The base configuration and mechanical joint to be designed to accept retaining/restraining devices for both AWWA C150 CL 52 ductile iron pipe and ANSI/AWWA C900, DR 18 PVC pipe hydrant leads.
- .8 Bury length: Type D of City of Ottawa Standards in accordance with W-19.
- .9 Hose outlet nozzle: 4 mm hose outlet nozzles conforming to ULC S-513 and approved for use by City of Ottawa.
- .10 Pumper Outlet Nozzle: approved for use by City of Ottawa.
- .11 Operator Nut: 32 mm square, direction to open to be counter-clockwise.
- .12 The hydrant is to be factory primed and finished painted. Hydrant finish paint: colour red, exterior enamel to CAN/CGSB-1.88.

**2.10 CATHODIC PROTECTION**

- .1 Anodes are to be attached to all new ductile iron fittings, ductile iron pipe, and valves. The size and type of anode to be in accordance with City of Ottawa Standards and W-39, W-40, W-41, and W-42, M.S. No. MW-19.9 and S.P. F-No. F-7093.

**2.11 BOLT CORROSION PROTECTION**

- .1 Anti-corrosion petrolatum paste, tape and mastic approved for use by City of Ottawa and in accordance with ANSI/AWWA C217.

**2.12 HYDROSATIC TEES**

- .1 Ensure two test tees are provided in each valve chamber, upstream and downstream of the valve, as per W-34.
- .2 52 mm diameter.

**2.13 PIPE BEDDING AND SURROUND MATERIAL**

- .1 Granular material to: Section 32 11 23 – Aggregate Base Courses.

**2.14 GEOTEXTILES**

- .1 Geotextile: Non-Woven, Class II, in accordance with OPSS 1860. Filtration opening size (FOS): maximum 70µm as per CAN/CGSB 148.1, Method No. 10.

**2.15 INSULATION**

- .1 Expanded polystyrene: to CAN/CGSB-51.20, Type 4, with 275 kPa compressive strength to ASTM D 1621, shiplapped edges, thickness as indicated.

**2.16 BACKFILL MATERIAL**

- .1 Type 1, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**Part 3 Execution****3.1 PREPARATION**

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
  - .1 Inspect materials for defects to approval of Departmental Representative.
  - .2 Remove defective materials from site as directed by Departmental Representative.
- .2 Ensure pipes delivered to site are provided with end caps and tamper evident seals.
- .3 Only remove end caps immediately before pipe is to be installed.

### 3.2 OPEN CUT TRENCH INSTALLATION

- .1 Trenching
  - .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
  - .2 Trench depth to provide cover over pipe of not less than 2.4 m from finished grade or as indicated.
  - .3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.
- .2 Geotextile: install as indicated.
- .3 Granular Bedding
  - .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm below bottom of pipe.
  - .2 Do not place material in frozen condition.
  - .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
  - .4 Shape transverse depressions in bedding as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.
  - .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .4 Pipe Installation
  - .1 Terminate building water service 1 m outside building wall or at property line opposite point of connection to main. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
  - .2 Lay pipes to ANSI/AWWA C600 and manufacturer's standard instructions and specifications. Do not use blocks except as specified.
  - .3 Join pipes in accordance with ANSI/AWWA C600 and manufacturer's recommendations.
  - .4 Bevel or taper ends of PVC pipe to match fittings.
  - .5 Handle pipe by methods recommended by pipe manufacturer. 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.
    - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
    - .2 Take up and replace defective pipe.
    - .3 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 grade of 2% or greater, face socket ends up-grade.

- .8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
  - .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
    - .1 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 Departmental Representative.
  - .11 Cut pipes in 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 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.
    - .1 Remove disturbed or contaminated gaskets.
    - .2 Clean, lubricate and replace 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 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
  - .19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
  - .20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
  - .21 Do not lay pipe on frozen bedding.
- .5 Pipe Surround
- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
  - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
  - .3 Place layers uniformly and simultaneously on each side of pipe.
  - .4 Do not place material in frozen condition.
  - .5 Compact each layer from pipe invert to pipe spring line to 95% maximum density to ASTM D698.
  - .6 From pipe spring line to 300 mm above top of pipe hand tamp material. Do not use mechanical tampers directly over pipe where cover is less than 300 mm.
- .6 Backfill remainder of trench.

**3.3 INSULATION**

- .1 Install insulation in accordance with W-23.

**3.4 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of concrete blocks, located between valve and solid ground. Bedding same as adjacent pipe. Valves not to be supported by pipe.

**3.5 VALVE BOXES**

- .1 Install as indicated to W-24.
- .2 Ensure valve boxes are centered over valve, vertical and free of debris.

**3.6 VALVE CHAMBERS**

- .1 Use precast units as approved by Departmental Representative.
- .2 Construct units as indicated, plumb and centred over valve nut, true to alignment and grade, and not resting on pipe.
  - .1 For Gate Valves, Refer to W-3.
- .3 Set precast concrete bases on 150 mm minimum compacted granular base material.
- .4 Set chamber section of precast unit on top of precast bases.
- .5 Set precast top section over chamber section.
- .6 Install adjustment units over valve chamber precast top. Set frame and cover directly n adjustment units. Do not use shims.
- .7 Plug lifting holes with precast concrete plugs set in cement mortar.
- .8 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.
- .9 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

**3.7 WATER MAIN CROSSINGS**

- .1 Prior to undertaking a crossing, daylight existing utility by means of vacuum excavation to confirm utility elevation and location.
- .2 Provide the clearances as indicated.

**3.8 TEST TEES**

- .1 Install test tees complete with ball valves as indicated and to accommodate flushing and disinfection, refer to W-34.

**3.9 HYDRANTS**

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA Manual of Practice and in conformance with City of Ottawa Standards. Refer to W-18 and W-19.
- .3 Install 152 mm gate valve and cast iron valve box on hydrant service leads as indicated to be 152 mm and in accordance with W-19.
- .4 Handle hydrants with appropriate slings and harness to avoid damage to painted surfaces. Any damage to paint work is to be repaired to the satisfaction of the Departmental Representative.
- .5 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with breakable flange set at elevation of 50 - 100 mm above final grade.
- .6 Restrain the hydrant lead at the tee connection to the main, on both sides of the valve, and at the base connection of the hydrant. In addition, provide a concrete thrust block as indicated in W-19 against undisturbed soil.
- .7 Ensure the drain holes are kept open and surrounded with clear stone.
- .8 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

**3.10 RESTRAINED JOINTS**

- .1 Restrain joints at all bends, tees, and valves in accordance with W-25.5 and W-25.6.

**3.11 CATHODIC PROTECTION**

- .1 All fittings are to be provided with cathodic protection in accordance with W-39, W-40, W-41, and W-42.

**3.12 BOLT CORROSION PROTECTION**

- .1 Liberally apply anti-corrosion petrolatum paste tape and mastic to all exposed nuts and bolts.

**3.13 TRACER WIRE**

- .1 Install tracer wire in accordance with W-36.



**3.14 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Do tests in accordance with City of Ottawa Standards F-7090-Commissioning of Watermains.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests.
- .3 Notify Departmental Representative at least 48 hours in advance of proposed tests.
  - .1 Perform tests in presence of Departmental Representative.
- .4 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .5 Open valves.
- .6 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.
- .7 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .8 Repeat hydrostatic test until all defects have been corrected and until leakage is within specified allowance for full length of watermain being tested.

**3.15 BACKFILL**

- .1 Refer to Section 31 23 33.01 – Excavating, Trenching and Backfilling.

**3.16 HYDRANT FLOW TESTS**

- .1 Undertake fire flow tests as per AWWA Manual M17 at each hydrant upon completion of installation, witnessed by Departmental Representative. Notify Departmental Representative a minimum of 48 hours in advance prior to undertaking test.

**3.17 PAINTING OF HYDRANTS**

- .1 After installation, touch up factory applied paint to satisfaction of Departmental Representative.
- .2 Paint hydrant caps and bonnets in accordance with NFPA 291 based on flow test results.

**3.18 FLUSHING AND DISINFECTING**

- .1 Flushing and disinfecting operations shall be undertaken by the City of Ottawa. Contractor will be responsible for obtaining and coordinating the services of the City of Ottawa. The Contractor shall include all costs in the tender amount and compensate the City for all related flushing and disinfecting fees.

**3.19 CONNECTION TO CITY OF OTTAWA WATERMAIN**

- .1 The connection to the City of Ottawa Sussex Drive Main will be by City of Ottawa forces under separate contract. Refer to Contract Drawings for location of water main connections.

**3.20 SURFACE RESTORATION**

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3        Section 32 11 23 – Aggregate Base Courses.
- .4        Section 33 05 13 – Manholes and Catch Basin Structures.

**1.2                MEASUREMENT PROCEDURES**

- .1        Included in Balance of Project.

**1.3                REFERENCES**

- .1        American Society for Testing and Materials International, (ASTM)
  - .1        ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .2        Canadian Standards Association (CSA International)
  - .1        CSA B1800-02, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
    - .1        CSA B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.
    - .2        CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).
    - .3        CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .3        Ontario Provincial Standard Specifications (OPSS)
  - .1        OPSS 409 (November 2013) Construction Specification For Closed-Circuit Television (CCTV) Inspection Of Pipelines.

**1.4                SUBMITTALS**

- .1        Submit product literature for storm sewer pipe in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Certification to be marked on pipe.

**Part 2 Products**

**2.1 OPEN CUT PIPE**

- .1 For pipe diameters up to and including 450 mm diameter:
  - .1 Plastic Pipe:
    - .1 Type PSM Polyvinyl Chloride (PVC): to CSA-B182.2.
    - .2 Standard Dimensional Ratio (SDR): 35.
    - .3 Locked-in gasket and integral bell system.
    - .4 Nominal lengths: 4m.

**2.2 PIPE BEDDING AND SURROUND MATERIAL OPEN CUT**

- .1 Granular base material: refer to Section 32 11 23 – Aggregate Base Courses.

**2.3 BACKFILL MATERIAL OPEN CUT**

- .1 Type 1 Fill to Section 31 23 33.01 - Excavating Trenching and Backfilling.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

**3.2 OPEN CUT TRENCHING**

- .1 Trenching:
  - .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
  - .2 Do not allow contents of sewer or sewer connection to flow into trench.
  - .3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.
- .2 Granular Bedding:
  - .1 Place bedding in unfrozen condition.
  - .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated up to spring line of pipe.
  - .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
    - .1 Do not use blocks when bedding pipes.
  - .4 Shape transverse depressions as required to suit joints.
  - .5 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.

- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins structures with compacted bedding material.
- .7 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 – Excavation, Trenching and Backfilling.
- .3 Pipe Installation:
  - .1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
  - .2 Handle pipe using methods approved by pipe manufacturer.
    - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
  - .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.
    - .1 Maximum allowable variation from indicated pipe invert elevations as measured at the maintenance holes and catch basins not to exceed 10 mm.
    - .2 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
  - .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
  - .6 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.
  - .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .8 Install plastic pipe and fittings in accordance with CSA B182.11.
  - .9 Joints:
    - .1 Plastic pipe:
      - .1 Gaskets integral with pipe.
      - .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 before joining.
      - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material. Lubricate gaskets before jointing is attempted.
      - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Do not install pipes with damaged or disturbed gaskets.
      - .6 Complete each joint before laying next length of pipe.
      - .7 Minimize joint deflection after joint has been made to avoid joint damage.
      - .8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

- .10 When any stoppage of Work occurs, restrain pipes to prevent "creep" during down time.
  - .11 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
  - .12 Make watertight connections to manholes and catch basins.
  - .13 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.
- .4 Pipe Surround
- .1 Place surround material in unfrozen condition.
  - .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
  - .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
    - .1 Do not dump material within 1 m of pipe.
  - .4 Place layers uniformly and simultaneously on each side of pipe.
  - .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.
  - .6 Compact each layer from mid height of pipe to underside of backfill to at least 90% maximum density to ASTM D698.
- .5 Backfill
- .1 Place backfill material in unfrozen condition.
  - .2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
  - .3 Under paving and walks, compact backfill to at least 95 % maximum density to ASTM D698. In other areas, compact backfill to at least 90 % maximum density to ASTM D698.

### **3.3 FIELD TESTING**

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Television and photographic inspections:
  - .1 Carry out Closed Circuit Television (CCTV) inspection of all new storm sewers, 200mm diameter or larger, in accordance with OPSS 409. Three (3) copies of the CCTV tapes and reports shall be submitted to the Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

**1.2                REFERENCES**

- .1        Canadian Standards Association (CSA)
  - .1        CSA C22.2 No. 211.1-M1984(R1999), Rigid Types EBI and DB2/ES2 PVC Conduit.

**1.3                SUBMITTALS**

- .1        Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4        Place materials defined as hazardous or toxic in designated containers.
- .5        Fold up metal banding, flatten and place in designated area for recycling.
- .6        Do not dispose of preservative treated wood through incineration.
- .7        Do not dispose of preservative treated wood with other materials destined for recycling or reuse. Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill as approved by Engineer.
- .8        Dispose of unused wood preservative material at official hazardous material collections site. Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.
- .9        Dispose of unused solvent cement at an official hazardous material collections sites as approved by Engineer. Do not dispose of unused solvent cement into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.

**Part 2 Products**

**2.1 PVC DUCTS AND FITTINGS**

- .1 Rigid PVC duct: to CSA C22.2 No. 211.1, Type DB2/ES2, with fabricated fittings, for direct burial.
- .2 Rigid PVC split ducts.
- .3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.
- .4 Rigid PVC 90° and 45° bends.
- .5 Rigid PVC 5° angle couplings.
- .6 Expansion joints as required.

**2.2 SOLVENT WELD COMPOUND**

- .1 Solvent cement for PVC duct joints.

**2.3 CABLE PULLING EQUIPMENT**

- .1 6 mm stranded nylon pull rope tensile strength 5 kN.

**2.4 MARKERS**

- .1 Concrete type cable markers: as indicated, with words: "Cable", "Joint" or "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

**PART 3 Execution**

**3.1 INSTALLATION**

- .1 Install duct in accordance with manufacturer's instructions.
- .2 Clean inside of ducts before laying.
- .3 Ensure full, even support every 1.5 m throughout duct length.
- .4 Slope ducts with 1 to 400 minimum slope.
- .5 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .6 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.



- .7 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.
- .8 Install markers as required.

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Provision of rigid conduit underground service ducts.

**1.2                RELATED SECTIONS**

- .1        Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2        Section 33 65 76 - Direct Buried Underground Cable Ducts.
- .3        Section 26 05 00 - Common Work Results - Electrical.
- .4        Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
- .5        Section 26 05 28 - Grounding - Secondary.
- .6        Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

**1.3                REFERENCES**

- .1        Canadian Standards Association (CSA)
  - .1        CSA A23.1/A23.2-00(June 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

**1.4                REGULATORY REQUIREMENTS**

- .1        Co-ordinate and meet requirements of power supply authority. Ensure availability of power when required.

**1.5                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4        Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.
- .5        Divert unused concrete materials from landfill to local facility as approved by Consultant.
- .6        Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                MATERIALS**

- .1      Underground ducts: to Section 33 65 76 - Direct Buried Underground Cable Ducts, rigid type, size as indicated.
- .2      Conductors: copper, type RWU-90, to Section 26 05 21, size and number of conductors as indicated.

**Part 3            Execution**

**3.1                INSTALLATION**

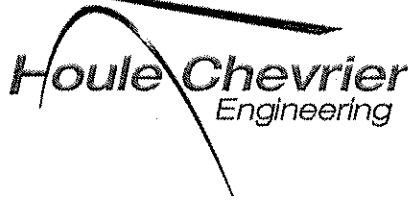
- .1      Install cables in trenches and in ducts in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
- .2      Allow adequate conductor length for connection to supply.
- .3      Allow adequate conductor length for connection to light standards.
- .4      Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

**3.2                FIELD QUALITY CONTROL**

- .1      Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2      Perform additional tests if required by authority having jurisdiction.

**END OF SECTION**

Houle Chevrier Engineering Ltd  
Report No.:13-337



**Houle Chevrier Engineering Ltd.**

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November 27, 2013

Our ref: 13-337

Delcan Corporation  
100 - 123 Michael Street  
Ottawa, Ontario  
K1J 7T2

Attention: Mr. Joe Vincelli, P.Eng.

RE: GEOTECHNICAL INVESTIGATION  
WATERMAIN REPLACEMENT AND PARKING AREA AND  
SERVICE ROAD REHABILITATION  
NATIONAL RESEARCH COUNCIL CANADA – SUSSEX DRIVE CAMPUS  
100 SUSSEX DRIVE  
OTTAWA, ONTARIO

Dear Sir:

Please find attached the geotechnical investigation report for the proposed watermain replacement and parking area and service road rehabilitation project at the National Research Council Canada Sussex campus, located at 100 Sussex Drive in Ottawa, Ontario.

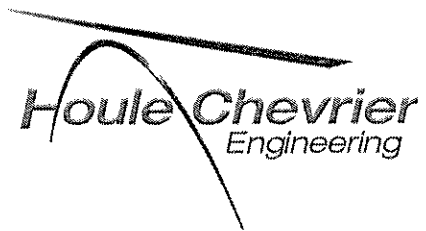
We trust that this report provides sufficient information for your current purposes. If you have any questions concerning the report, please call.

Yours truly,

HOULE CHEVRIER ENGINEERING LTD.

A handwritten signature in black ink, appearing to read "B. Wiebe", is written over the company name.

Brent Wiebe, P.Eng.



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REPORT ON

GEOTECHNICAL INVESTIGATION  
WATERMAIN REPLACEMENT AND PARKING AREA AND  
SERVICE ROAD REHABILITATION  
NATIONAL RESEARCH COUNCIL CANADA  
SUSSEX DRIVE CAMPUS  
100 SUSSEX DRIVE  
OTTAWA, ONTARIO

Submitted to:

Delcan Corporation  
100 – 1223 Michael Street  
Ottawa, Ontario  
K1J 7T2

November 2013

Our ref: 13-337

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## **1.0 INTRODUCTION**

This report presents the results of a subsurface investigation carried out for the proposed watermain replacement and parking area and service road rehabilitation project at the Sussex Drive Campus of the National Research Council Canada (NRC) in the City of Ottawa, Ontario. The purpose of the investigation was to assess the pavement structure, identify the general subsurface conditions at the site by means of a limited number of boreholes and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

The subsurface investigation was carried out in accordance with our proposal dated July 15, 2013.

## **2.0 PROJECT AND SITE DESCRIPTION**

### **2.1 Project Description**

Plans are being prepared to replace the existing watermain at the Sussex Drive campus of the National Research Council Canada (NRC) in the City of Ottawa, Ontario (see Key Plan, Figure 1). It is understood that the scope of the project includes the watermain replacement and rehabilitation of the parking areas and service roads at 100 Sussex Drive.

### **2.2 Review of Geology Maps**

Surficial geology maps of the Ottawa area indicate that the overburden deposits at the site are composed of glacial till. The overburden ranges from 1 to 10 metres thick and is underlain by interbedded limestone and shale of the Verulam Formation. Fill material associated with past development of the site should also be anticipated.

### **2.3 Previous Investigations by Houle Chevrier Engineering Ltd.**

A previous geotechnical report was prepared by Houle Chevrier Engineering Ltd., dated March 2012, for the proposed steam line located between the NRC Boiler Plant building at 100 Sussex Drive and the Macdonald-Cartier Bridge in Ottawa, Ontario. At that time three (3) boreholes, numbered 12-1 to 12-3, inclusive, were advanced along the proposed steam line. Boreholes 12-2 and 12-3 were located in the vicinity of the parking areas and proposed watermain replacement. The record of borehole sheets for boreholes 12-2 and 12-3 are provided in Appendix C.

### 3.0 SUBSURFACE INVESTIGATION

The field work for this investigation was carried out on September 3, 2013. At that time, eleven (11) boreholes, numbered 13-1 to 13-11, inclusive, were advanced at the site. The boreholes were advanced to depths ranging from about 1.4 to 3.8 metres below existing ground surface using a truck mounted, hollow stem auger drill rig supplied and operated by George Downing Estate Drilling Ltd. of Grenville-sur-la-Rouge, Quebec. Boreholes 13-2, 13-5, 13-6, 13-8, 13-9 and 13-11 were advanced for the watermain replacement. The results of all the boreholes, with the exception of borehole 13-5, were used for the pavement rehabilitation.

Standard penetration tests were carried out in the boreholes, and samples of the soils encountered were recovered using a 50 millimetre diameter split barrel sampler. The subsurface conditions encountered in the upper 0.7 metres of the boreholes were identified by visual and tactile examination of the materials exposed on the sides of the boreholes. Grab samples of the soils encountered within this depth were recovered manually.

Well screens were sealed in the overburden in boreholes 13-5 and 13-11 to measure the groundwater levels. The field work was observed by a member of our engineering staff who directed the drilling operations, observed the in situ testing and logged the samples and boreholes.

Following the field work, the soil samples were returned to our laboratory for examination by a geotechnical engineer. One (1) soil sample recovered from borehole 13-11 was sent to Paracel Laboratories Ltd. for basic chemical testing relating to corrosion of buried concrete and steel. Selected samples of the soil were tested for water content and grain size distribution.

Descriptions of the subsurface conditions logged in the boreholes are provided on the Record of Borehole sheets in Appendix A. The approximate locations of the boreholes are shown on the Borehole Location Plan, Figure 2. The results of the laboratory testing are provided on Figures 3 to 5.

The borehole locations were selected by Houle Chevrier Engineering Ltd. personnel and positioned at the site relative to existing site features. The locations of the boreholes and

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ground surface elevations at the boreholes were determined using a Trimble R8 GPS survey instrument. The elevations are referenced to Geodetic datum.

## **4.0 SUBSURFACE CONDITIONS**

### **4.1 General**

As previously indicated, the soil and groundwater conditions identified in the boreholes are given on the Record of Borehole sheets in Appendix A. The borehole logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of drilling, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at areas other than the test locations may vary from the conditions encountered in the boreholes. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties.

The groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These conditions may vary seasonally or as a consequence of construction activities in the area.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and Houle Chevrier Engineering Ltd. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The following presents an overview of the subsurface conditions encountered in the boreholes advanced during this investigation.

### **4.2 Previous Investigation (Boreholes 12-2 and 12-3)**

As indicated above, boreholes 12-2 and 12-3 were advanced in the vicinity of the parking areas and proposed watermain replacement. The locations of these boreholes are provided on Figure 2 and the results of the boreholes are provided in Appendix C. From ground surface boreholes 12-2 and 12-3 encountered a layer of topsoil fill having a thickness of about 0.2 to 0.3 metres. The topsoil fill is underlain by fill material composed of sand, sand and gravel, silty clay, silty sand, boulders and wood fragments. Borehole 12-2 encountered possible gravel fill or weathered bedrock at a depth of about 1.8 metres below ground surface. The borehole was

terminated within this layer at about 3.1 metres below ground surface. Borehole 12-3 encountered a native deposit of grey silty clay at about 3 metres below ground surface. The borehole was terminated within this deposit at a depth of about 3.1 metres below ground surface.

#### **4.3 Existing Pavement Structure**

Asphaltic concrete was encountered from ground surface in all boreholes, with the exception of BH13-5. The asphaltic concrete ranges in thickness from about 60 to 170 millimetres and is underlain by roadway base material.

At boreholes 13-2, 13-10 and 13-11, the asphaltic concrete is underlain by roadway base and subbase materials. The base material is composed of grey and brown sand and gravel and has a thickness of about 70 to 280 millimetres. The subbase material is composed of brown, grey and dark grey, fine to coarse grained sand and gravel and ranges in thickness from about 100 to 360 millimetres.

At boreholes 13-1, 13-3, 13-4, and 13-6 to 13-9, there was no obvious distinction between the base and subbase materials. At these locations the base/subbase is composed of grey sand and gravel having a thickness of between 260 and 620 millimetres.

The results of grain size distribution testing on samples of the base material recovered from boreholes 13-2 and 13-10 and the base/subbase material from borehole 13-4 are provided on Figure 3 along with the grain size distribution envelope for Ontario Provincial Standard Specification (OPSS) Granular A. The samples do not meet the gradation requirements for OPSS Granular A due to excess amounts of silt size particles in boreholes 13-2 and 13-4 (12 and 15 percent versus the maximum of 8 percent in the OPSS requirement) and an excess amount of gravel in BH 13-10. Moisture content testing carried out on samples of the roadway base material and the base/subbase material from borehole 13-4 indicate moisture contents around 3 percent.

The results of grain size distribution testing on samples of the subbase material recovered from boreholes 13-2 and 13-10 are provided on Figure 4 along with the grain size distribution envelope for OPSS Granular B Type II. The sample from borehole 13-2 does not meet the

gradation requirements for OPSS Granular B Type II due to an excess amount of silt size particles (16 percent versus the maximum of 8 percent in the OPSS requirement). The sample from borehole 13-10 meets the gradation requirements for OPSS Granular B Type II. Moisture content testing carried out on samples of the roadway subbase material indicate moisture contents ranging from about 3 to 6 percent.

#### **4.4 Topsoil Fill**

Borehole 13-5 encountered topsoil fill from ground surface. The topsoil fill is composed of dark brown sand with some silt and organic material and has a thickness of about 130 millimetres.

#### **4.5 Fill Material**

Fill material was encountered beneath the roadway structure and topsoil in all boreholes. The fill material is variable in nature and can generally be described as sand/sand and gravel with varying amounts of silt and clay as well as silty clay/clayey silt with varying amounts of sand and gravel. The fill material has a thickness of about 0.5 to 1.4 metres and extends to a depth of about 1.3 to 2.7 metres below ground surface (elevation 55.6 to 54.1 metres, geodetic datum), respectively. Cobbles were observed within the fill material.

Standard penetration tests carried out in the fill material gave N values ranging from 8 to 31 blows per 0.3 metres of penetration, which reflect a variable, loose to dense relative density.

Boreholes 13-3, 13-7 and 13-10 were terminated within the layer of fill at depths of about 1.5 metres below ground surface (elevation 55.1 to 55.2 metres, geodetic datum).

#### **4.6 Possible Fill Material**

Possible fill material was encountered beneath the roadway structure or topsoil in boreholes 13-5, 13-6 and 13-8. Fill material is difficult to distinguish from the native soils, being of a similar composition, and is often only identifiable by the presence of erroneous material (e.g. brick fragments, asphaltic concrete pieces, etc.). Since it could not be confirmed if the material is fill material (i.e., we did not encounter erroneous material), the material was labeled as 'possible fill'.



The possible fill material is variable in nature and can generally be described as brown, dark brown and grey sand, sandy gravel and sand and gravel. The possible fill material has a thickness ranging from about 0.4 to 2.1 metres and extends to a depth of about 0.8 to 2.7 metres below ground surface (elevation 54.1 to 55.4 metres, geodetic datum). The water content of samples of the possible fill material ranges from about 4 to 10 percent.

The results of a grain size distribution test on a sample of the sandy gravel from borehole 13-5 are provided on Figure 5. The testing indicates that the sample contains about 56 percent gravel, 23 percent sand, 13 percent silt and 8 percent clay size particles.

#### **4.7 Sand and Gravel**

A deposit of sand and gravel was encountered beneath the fill in borehole 13-9.

A standard penetration test carried out in this deposit gave an N value of about 90 blows per 0.3 metres of penetration, which reflects a very dense relative density.

#### **4.8 Clayey Silt**

A layer of clayey silt was encountered in borehole 13-11 at a depth of about 2.1 metres. The clayey silt has a thickness of 0.6 metres and extends to a depth of about 2.8 metres below ground surface (elevation 54.1 metres, geodetic datum).

One standard penetration test carried out in the clayey silt gave an N value of 4 blows per 0.3 metres of penetration indicating a stiff to very stiff consistency.

The results of a grain size distribution test on a sample of the clayey silt from borehole 13-11 are provided on Figure 5. The testing indicates that the sample contains about 14 percent sand, 58 percent silt and 28 percent clay size particles.

#### **4.9 Bedrock**

Possible weathered bedrock was encountered below the fill material in boreholes 13-2, 13-6 and 13-8, below the sand and gravel in borehole 13-9 and below the clayey silt in borehole 13-11.

Standard penetration tests carried out in the possible weathered bedrock at boreholes 13-6, 13-8 and 13-11 gave N values of 60 blows per 0.2 metres and 50 blows per 0.1 metres of penetration.

Auger refusal on inferred bedrock was encountered in boreholes 13-1, 13-2, 13-4, 13-5, 13-6, 13-8, 13-9 and 13-11 at depths ranging from 1.4 to 3.8 (elevation 53.1 to 55.4 metres, geodetic datum).

It should be noted that the bedrock depth encountered in the boreholes may reflect past excavation activities.

#### 4.10 Groundwater Levels

The well screens installed in boreholes 13-5 and 13-11 were dry on September 13, 2013.

The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

#### 4.11 Groundwater Chemistry Relating to Corrosion

The results of chemical testing of a soil sample from borehole 13-11 is provided in Appendix B and summarized in the following table:

Parameter	Level
Chloride Content ( $\mu\text{g/g}$ )	976
Resistivity (Ohm.metre)	5.15
pH	7.96
Sulphate Content ( $\mu\text{g/g}$ )	158

The results of the chemical testing are discussed in Section 5.2.9.

## **5.0 DESIGN GUIDELINES**

### **5.1 General**

The information in the following sections is provided for the guidance of the design engineers and is intended for the design of this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions. The implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from offsite sources are outside the terms of reference for this report and have not been addressed.

### **5.2 Proposed Watermain**

#### **5.2.1 Overburden Excavation**

The excavation for the watermain construction will be carried out through asphaltic concrete, roadway granular material, topsoil, fill material and sand and gravel.

In the overburden, the excavation for flexible service pipes should be in accordance with Ontario Provincial Standard Drawing (OPSD) 802.010 for Type 3 Soil. The excavation for rigid service pipes should be in accordance with OPSD 802.031 for Type 3 soil.

Fill material can be random in nature and may contain cobbles and boulders. The contractor should be made aware of the requirement to remove boulder size material as part of the excavation works. Some of the boulders may have to be wasted from the 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. As an alternative or where space constraints dictate, the service installation could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose.

The well screens installed in boreholes 13-5 and 13-11 were dry on September 13, 2013. The proposed invert level of the pipe is expected to be about 2.5 to 3.0 metres below ground surface. No unusual constraints are expected in excavating the fill and sand and gravel deposits above the groundwater level.

### **5.2.2 Bedrock Excavation**

In bedrock, the excavation for flexible service pipes should be in accordance with Ontario Provincial Standard Drawing (OPSD) 802.013 for bedrock. The excavation for rigid service pipes should be in accordance with OPSD 802.033 for bedrock.

Based on our experience in the vicinity of the site, localized bedrock removal at this site could be carried out using hoe ramming techniques in conjunction with line drilling on close centres. Provided that good bedrock excavation techniques are used, the bedrock could be excavated using vertical side walls. Any loose rock should be scaled from the sides of the excavation.

Significant effort may be required to break the bedrock with a hoe ram, particularly if a thick bed and/or hard bedrock is encountered. In order to reduce over break and/or under break of the bedrock in areas where the excavation will be carried out next to an existing site service or structure, it is suggested that the limit of excavation be defined by line drilling on close centers. For the bedrock at this site, it is suggested that allowance be made for line drilling 75 to 100 millimetre diameter holes on 200 to 300 millimetre centres.

The vibration effects of hoe ramming are usually significantly lower and more localized than those associated with blasting; however, there may be equipment in the building that is sensitive to vibration. Therefore, we recommend that a threshold vibration limit be established in advance of construction based on the specific uses in the building. If the client indicates that the building uses are not sensitive to vibration, a threshold limit of 50 millimetres per second could be used. Lower threshold values may be required for any freshly placed concrete. Monitoring of the hoe ramming could be carried out to measure the vibrations to ensure that

they are below the acceptable threshold values. Pre-construction condition surveys of nearby structures and existing buried services are recommended so that any post-construction claims can be handled in a fair manner.

### **5.2.3 Groundwater Pumping and Management**

No groundwater was observed in the well screens in boreholes 13-5 and 13-11 on September 13, 2013. Groundwater inflow from the overburden deposits and bedrock, if any, should be controlled by pumping from filtered sumps within the excavation. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services.

Based on the groundwater measurements to date, and assuming there is no increase in the groundwater level and that the maximum depth of excavation is about 3.0 metres, the rate of groundwater inflow into the excavations should not exceed 50,000 litres per day. As such, a Permit to Take Water (PTTW) is likely not required for this project. A PTTW could be obtained as a precautionary measure in the event that the construction proceeds during a wet period of the year when the groundwater levels may be higher.

Suitable detention and filtration will be required before discharging the water to any sewers. The contractor should be required to prepare and submit an excavation and groundwater management plan for review and approval as part of the contract.

### **5.2.4 Pipe Bedding**

The bedding for the new watermain should be in accordance with OPSD 802.010 and OPSD 802.013 for flexible pipes in earth excavation and bedrock excavation, respectively, and OPSD 802.031 and OPSD 802.033 for rigid pipes in earth excavation and bedrock excavation, respectively. The pipe bedding material should consist of at least 150 millimetres of well graded crushed stone meeting OPSS for Granular A. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular A material. Since the source of recycled material cannot be determined, it is suggested that any granular materials used in the service trench be composed of virgin (i.e., not recycled) material only.

In areas where unsuitable material (such as existing fill material) exists below the pipe subgrade level, or where the subgrade becomes disturbed (for example due to groundwater inflow), the unsuitable/disturbed material should be removed and replaced with a subbedding layer of compacted granular material, such as that meeting OPSS Granular B Type II (50 or 100 millimetre minus crushed stone). To provide adequate support for the pipes in the long term in areas where subexcavation of material is required below design subgrade level, the excavations should be sized to allow a 1 horizontal to 2 vertical spread of granular material down and out from the bottom of the pipe. 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 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value.

#### **5.2.5 Thrust Restraint for Watermain**

Based on the results of the boreholes, the subsurface at the depth of the proposed watermain will likely consist of trench backfill, sand and gravel or limestone bedrock. In areas where the subgrade for the thrust block is disturbed or where unsuitable material (such as existing fill material) exists below the pipe subgrade level, the disturbed/unsuitable material should be removed and replaced with a layer of compacted granular material, such as that meeting OPSS Granular B Type II. The Granular B Type II material should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. The following parameters could be used for design purposes:

Coefficient of friction between granular backfill and smooth PVC pipe:	0.25
Bearing pressure for thrust blocks bearing on native deposits of sand and gravel	100 kilopascals
Bearing pressure for thrust blocks bearing on a pad of compacted granular material above native overburden deposits or bedrock	100 kilopascals

Bearing pressure for thrust blocks bearing on sound bedrock

500 kilopascals

The above allowable bearing pressures for the thrust blocks assume that they are vertical and bear on or within the native deposits, or on a pad of compacted granular material above the native deposits or bedrock, or on sound bedrock.

### **5.2.6 Trench Backfill**

To reduce the potential for differential frost heaving between the area over the trench and the adjacent parking area, acceptable native materials should be used as backfill between the parking area subgrade level and the depth of seasonal frost penetration (i.e., 1.8 metres below finished grade). Where these cover requirements are not practicable, the pipe could be protected from frost using a combination of earth cover and insulation. Further details regarding insulation could be provided, if required. The backfill materials within the zone of frost penetration should 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 II.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, parking areas, 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, the overburden backfill could be compacted to at least 90 percent of the standard Proctor dry density value, provided that some settlement of the finished ground surface is acceptable.

The fill materials are sensitive to changes in moisture content and precipitation. Depending on the weather conditions encountered during the construction, 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 trench, 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 trench and make provision to defer final

paving of surface course (i.e., the Superpave 12.5 asphaltic concrete) above the trench for 3 months, or longer, to allow the trench backfill settlement to occur and thereby improve the final roadway/parking lot appearance.

### **5.2.7 Seepage Barriers**

Based on the groundwater levels observed in the well screens, along with the subsurface conditions encountered in the boreholes, seepage barriers are not required along the watermain trench if the proposed excavation depths do not exceed 3.0 metres. If the proposed excavation depths for the watermain exceed 3.0 metres, further analysis and recommendations can be provided upon request.

### **5.2.8 Winter Construction**

In order to carry out the work during freezing temperatures and maintain adequate performance of the trench backfill as a roadway subgrade, the service trench should be opened for as short a time as practicable and the excavations should be carried out only in lengths which allow all of the construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the trench 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.

### **5.2.9 Corrosion of Buried Concrete and Steel**

The measured sulphate concentration in a sample of the clayey silt was 158 micrograms per gram. According to Canadian Standards Association (CSA) "Concrete Materials and Methods of Concrete Construction", the concentration of soluble sulphate in the soil is in the low range. Therefore, any concrete in contact with the soil in this area could be batched with General Use (GU) cement. The effects of freeze thaw in the presence of de-icing chemical (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 and pH of the sample, the soil in this area can be classified as aggressive towards unprotected steel. It is noted that the corrosivity of the soil/groundwater could vary throughout the year due to the application sodium chloride for de-icing.



### 5.3 Roadway Rehabilitation

#### 5.3.1 Pavement Condition Evaluation

It is understood that consideration is being given to rehabilitating the parking areas and service roads at this site. The condition of the access roadways and parking areas were evaluated as part of our investigation. The following summarizes our condition evaluation of the existing asphaltic concrete:

##### *West Access Road*

- Moderate coarse aggregate loss (raveling) was observed throughout; and
- Slight to severe longitudinal centerline cracking was observed throughout.

##### *Corridor Adjacent to North Side of Building*

- Moderate coarse aggregate loss (raveling) was observed throughout;
- Slight to severe longitudinal and transverse single and multiple cracks were observed on an intermittent to frequent basis; and
- Slight to moderate transverse and longitudinal alligator cracking was observed intermittently;

##### *North Parking Area*

- Moderate coarse aggregate loss (raveling) was observed throughout;
- Moderate to severe longitudinal cracks were observed throughout, likely along construction joints;
- Slight to severe longitudinal and transverse single and multiple cracks were observed on an intermittent to frequent basis; and
- Slight to very severe transverse and longitudinal alligator cracking was observed intermittently;

##### *East Parking Area*

- Moderate coarse aggregate loss (raveling) was observed throughout;
- Slight to severe longitudinal and transverse single and multiple cracks were observed intermittently. The longitudinal cracks are likely associated with construction joints;

- Slight to very severe transverse alligator cracking was observed intermittently;

#### *East Access Road*

- Moderate coarse aggregate loss (raveling) was observed throughout; and
- Slight to moderate longitudinal and transverse cracks were observed intermittently;

It should be noted that the majority of the cracks observed in the access roadways and parking areas had been sealed; however, some isolated re-opening of these cracks was observed.

Surface water drainage at the site is provided by catch basins and storm sewers.

### **5.3.2 Pavement Rehabilitation Alternatives**

Typical pavement rehabilitation alternatives include: pavement overlay, removal and replacement of asphaltic concrete, in situ pulverization and full reconstruction. In our opinion, a pavement overlay at this site would result in reflective cracking due to the existing cracks in the asphaltic concrete within about 2 years. Therefore, we have only provided our comments on removal and replacement (Alternative 1), in-situ pulverization (Alternative 2) and full reconstruction (Alternative 3). It is noted that the existing subbase and base materials do not meet OPSS requirements for Granular B Type I and Granular A due to the percentage of silt size particles, which may affect the performance of the roadway (for removal and replacement and in situ pulverization rehabilitation alternatives). The rehabilitation alternatives provided are considered appropriate for both heavy vehicle access routes and car and light truck parking areas, although it should be noted that the sections below provide separate suggested pavement structures for these uses.

Rehabilitation is not considered essential for the newly rebuilt section of access roadway on the east side of the building.

#### *5.3.2.1 Alternative 1 - Removal and Replacement of Asphaltic Concrete*

Consideration could be given to removing the existing asphaltic concrete and resurfacing with new asphaltic concrete. For the access roadways and the corridor on the north side of the building (which may be used by heavy vehicles, including fire trucks), the asphaltic concrete surfacing thickness should be at least 90 millimetres (40 millimetres of Superpave 12.5, over 50

millimetres of Superpave 19.0, Traffic Level B). In the parking areas that are used by cars only, the asphaltic concrete thickness should be at least 50 millimetres (Superpave 12.5, Traffic Level B). Alternatively, 90 millimetres of asphaltic concrete could be used throughout to improve performance and more closely match the thickness of the existing asphaltic concrete.

Following the removal of the existing asphaltic concrete, the surface of the existing base material should be regraded and compacted to at least 98 percent of the standard Proctor dry density value. A leveling layer composed of OPSS Granular A should be placed, where required, and should be compacted in maximum 200 millimetre thick lifts and compacted to at least 98 percent of the standard Proctor dry density value.

The design life of this alternative is expected to be about 5 to 8 years. With the replacement of the asphaltic concrete, reflective cracking will be mitigated. However, allowance should be made for periodic crack sealing to reduce deterioration of the pavement due to the ingress of water.

#### *5.3.2.2 Alternative 2 - In situ Pulverization and Resurfacing*

The existing asphaltic concrete could be pulverized and mixed with the underlying granular materials, and the mixed and pulverized material topped with a thin (levelling) layer of OPSS Granular A and new asphaltic concrete. Compared with removal and replacement of the asphaltic concrete, pulverization and mixing improves the performance of the existing granular materials by blending material with the existing base and eliminates the need for off site disposal of the asphaltic concrete. Based on the thickness of the existing asphaltic concrete at the borehole locations, conventional pulverization equipment should be suitable. Assuming that pulverization and mixing is carried out to a depth of about 200 millimetres, the blended material should contain about 50 percent by volume of bituminous material, which is considered acceptable. Milling in advance of pulverization will be required where the asphaltic concrete exceeds about 110 millimetres (for example, borehole 13-10).

Following pulverization, regrading should be carried out, where required. Allowance should be made to place a thin layer of OPSS Granular A prior to placing the new asphaltic concrete surfacing.

In the parking areas the pulverized mixture and leveling layer of OPSS Granular A could be topped with at least 50 millimetres of hot mix asphaltic concrete (Superpave 12.5 millimetre, Traffic Level B). For the access roadways and the corridor on the north side of the building, the pulverized mixture and leveling layer could be topped with 40 millimetres of Superpave 12.5, over 50 millimetres of Superpave 19.0 (Traffic Level B). It should be noted that removal of some of the pulverized material may be required to maintain an acceptable curb height. However, in our experience, it is usually possible to reduce the amount of removal required by leveling out the pulverized mixture to low portions of the parking lot or roadway and by increasing the crown of the parking lot/roadway surface.

All imported granular and pulverized materials 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.

The design life of the pulverized alternative is expected to be about 8 to 12 years. With in situ pulverization, reflective cracking will be mitigated. Notwithstanding, allowance should be made for periodic crack sealing to reduce the pavement deterioration due to the ingress of water.

#### *5.3.2.3 Alternative 3 - Full Reconstruction*

In preparation for full reconstruction, the existing asphaltic concrete and granular materials should be removed to the design pavement depth. The subgrade surface should then be proof rolled with a large steel drum roller. Any soft areas evident from the proof rolling and any organic or otherwise deleterious materials should be subexcavated and replaced with suitable earth borrow material. This need not include the removal of the existing fill material. In areas where abrupt changes in the frost susceptibility of the subgrade materials are encountered, frost tapers and/or some subexcavation of materials may be required to prevent future localized differential frost heaving of the pavement structure. The frost taper and subexcavation requirements should be assessed at the time of construction by geotechnical personnel.

For full reconstruction, the following minimum pavement structure could be considered for the parking areas:

50 millimetres of hot mix asphaltic concrete (Superpave 12.5, Traffic Level B), over  
150 millimetres of OPSS Granular A, over  
300 millimetres of OPSS Granular B Type II (50 or 100 millimetre minus crushed stone).

For the access roadways and the corridor on the north side of the building, the thickness of the asphaltic concrete should be increased to 90 millimetres (40 millimetres of Superpave 12.5, over 50 millimetres of Superpave 19.0, Traffic Level B), and the OPSS Granular B Type II thickness should be increased to 400 millimetres.

Performance Grade PG 58-34 should be specified for the asphaltic concrete at this site.

The above pavement structure assumes that the subgrade surface is prepared as described in this report. If the subgrade surface is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or to incorporate a woven geotextile separator between the subgrade surface and the granular subbase material.

The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

To avoid cracking of the asphaltic concrete due to an abrupt change in the thickness of the roadway granular materials where the new pavement structure joins with an existing pavement, the granular depths should taper up or down at 5 horizontal to 1 vertical to match the existing pavement structure.

All imported granular materials 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.

The design life for a reconstructed pavement is about 20 years, with resurfacing in about 12 to 15 years.

### **5.3.3 Transition Treatments**

In areas where the rehabilitated pavement structure will abut existing pavements, the depths of the granular materials should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the depths of the granular material(s) exposed in the existing pavement.

### **5.3.4 Pavement Drainage**

If possible, it is suggested that filter wrapped, perforated subdrains be installed at the catch basins in the access roadways and parking areas. The catch basins should be provided with 3 metre (minimum) long perforated stub drains which extend in at least two directions from the catch basin at the pavement subgrade level.

### **5.3.5 Effects of Soil Disturbance and Construction Traffic**

The guidelines above for the trench reinstatement and parking area rehabilitation assume that the trench backfill is adequately compacted, and prepared as described in this report. If the subgrade surface above the watermain becomes disturbed or wetted due to construction operations or precipitation, the Granular B Type II thickness given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or to incorporate a woven geotextile separator between the roadway subgrade surface and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

If the granular pavement materials above the trenches are to be used by construction traffic, it may be necessary to increase the thickness of the Granular B Type II, install a woven geotextile separator between the subgrade surface and the granular material, or a combination, to prevent pumping and disturbance to the subbase material. The contractor should be made responsible for their construction access.

### **5.3.6 Effects of Existing Service Trenches**

Differential frost heaving could occur in areas where abrupt changes in the frost susceptibility of the subgrade materials exist. The locations of any service trenches that cause differential frost heaving issues during the winter period should be identified at the design stage. To mitigate

future differential frost heaving at these locations, granular frost tapers (sloped at 5 horizontal to 1 vertical, or flatter) and/or some subexcavation of materials could be carried out as part of the rehabilitation. The frost heave treatment could be assessed at the time of the construction by geotechnical personnel.

#### **5.4 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. There may be equipment in the building that is sensitive to vibration. Therefore, we recommend that a threshold vibration limit be established in advance of construction based on the specific uses in the building.

We recommend that preconstruction surveys be carried out on the adjacent structures and that vibration monitoring be carried out during the construction so that any damage claims can be addressed in a fair manner.

#### **5.5 Design Review and Construction Observation**

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the final design drawings be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended. The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the watermain and parking area should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

## **6.0 LIMITATION OF LIABILITY**

This report was prepared for Delcan Corporation and the National Research Council Canada and the work referred to within it has been undertaken by Houle Chevrier Engineering Ltd. (HCEL). It is intended for the exclusive use of Delcan Corporation and the National Research Council Canada. This report may not be relied upon by any other person or entity without the express written consent of HCEL, Delcan Corporation and the National Research Council Canada. Nothing in this report is intended to provide a legal opinion.

The investigation undertaken by HCEL with respect to this report and any conclusions or recommendations made in this report reflect the best judgements of HCEL 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, subsurface investigations at discrete locations and depths and laboratory analyses of 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.

Should new information become available during future work, including excavations, borings or other studies, HCEL 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.

Yours truly,

HOULE CHEVRIER ENGINEERING LTD.



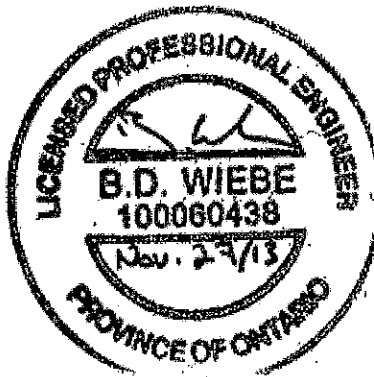
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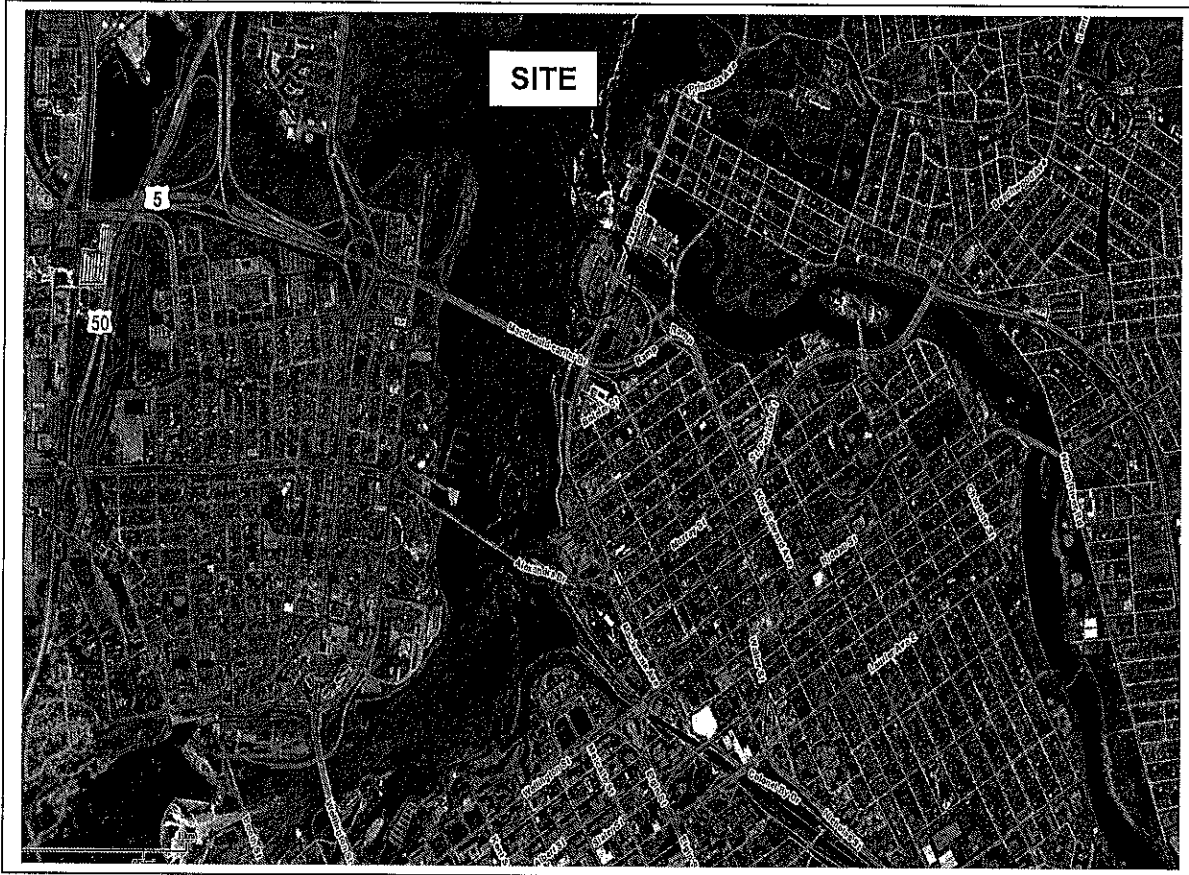


Brent Wiebe, P.Eng.

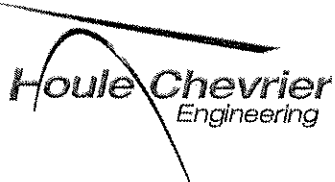


Andrew Chevrier, M.Eng., P.Eng.  
Principal



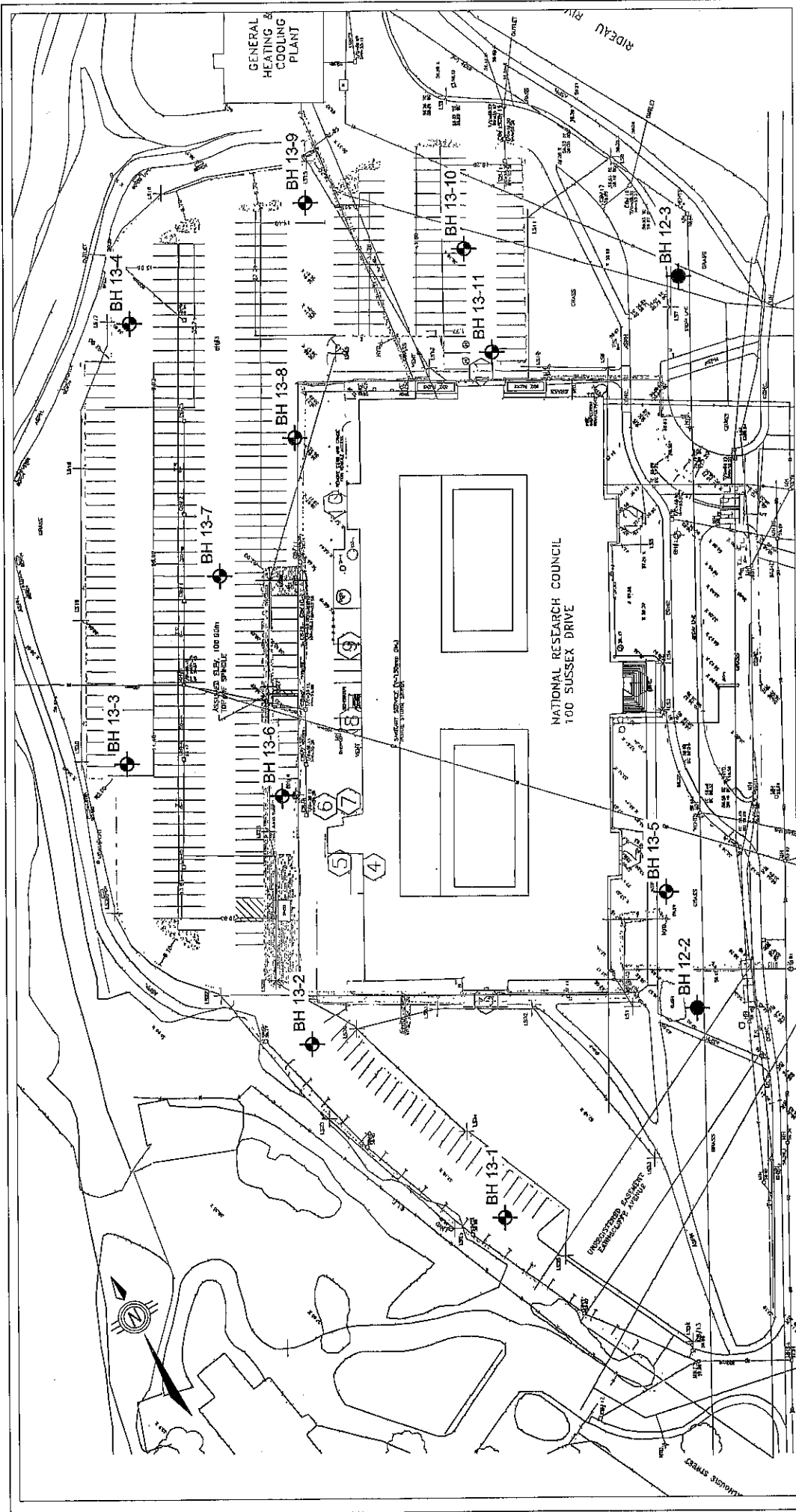



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Date: November 2013

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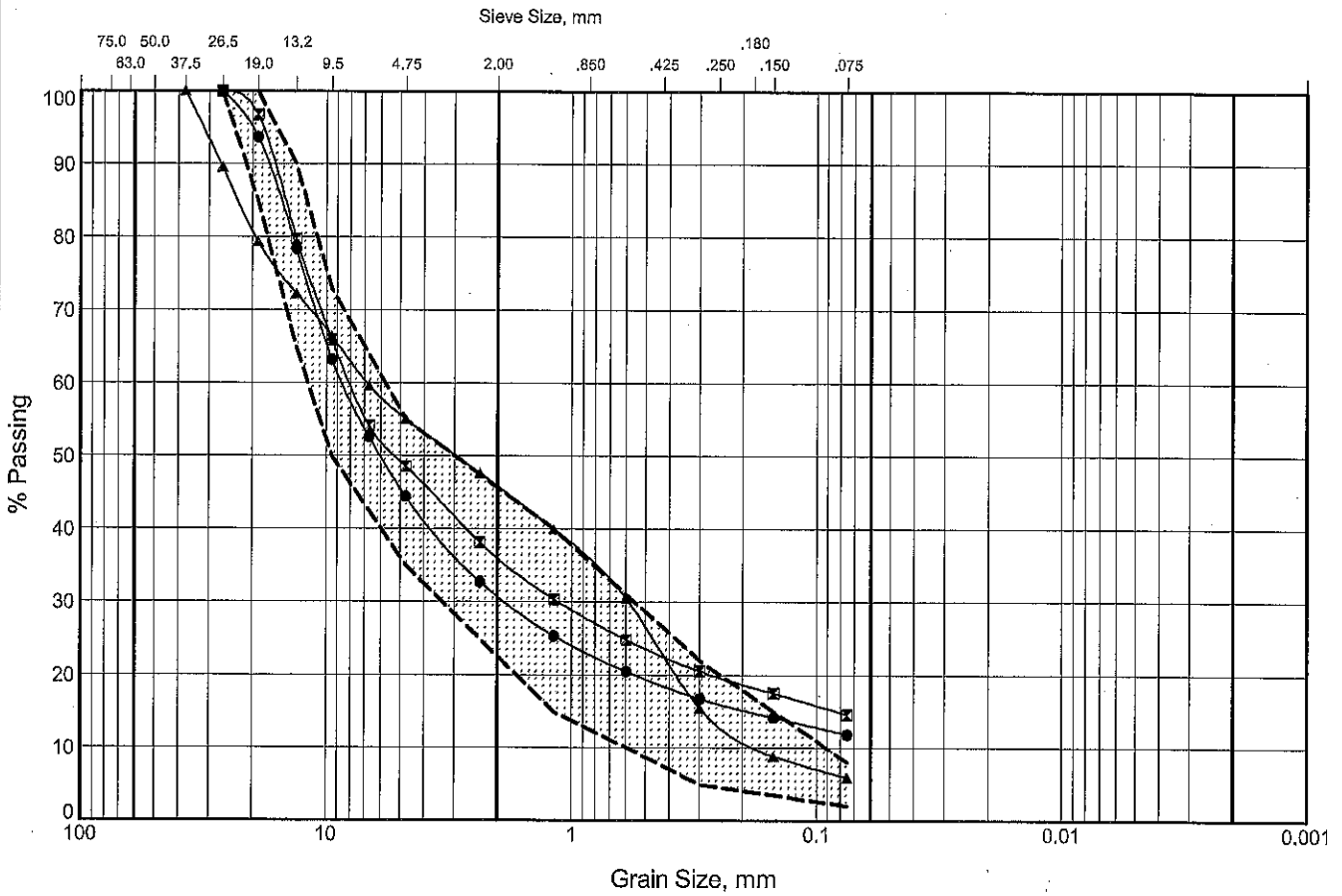


Client	DELCAN CORPORATION	Location	100 SUSSEX DRIVE OTTAWA, ONTARIO	Revision	0
Drawn by	A.N.	Approved by	B.W.	Project No.	13-337
Title			BOREHOLE LOCATION PLAN		
Date			NOVEMBER 2013		
			<b>BOREHOLE LOCATION PLAN</b> Date: NOVEMBER 2013 Figure: <b>FIGURE 2</b>		

- LEGEND**
-  BH 13-1 APPROXIMATE BOREHOLE LOCATION IN PLAN, CURRENT INVESTIGATION BY HOULE CHEVRIER ENGINEERING LTD.
  -  BH 12-2 APPROXIMATE BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATION BY HOULE CHEVRIER ENGINEERING LTD.

# GRAIN SIZE DISTRIBUTION

## FIGURE 3



SOILS GRAIN SIZE GRAPH - GINT LOGS SEPTEMBER 3 2013.GPJ HOULE CHEVRIER FEB 9 2011.GDT 11/27/13

Borehole	Sample	Depth (m)	Legend
13-2	1	0.1 - 0.4	●
13-4	1	0.1 - 0.4	☒
13-10	1	0.2 - 0.4	▲

----- Gradation Envelope: OPSS 1010 - GRANULAR A

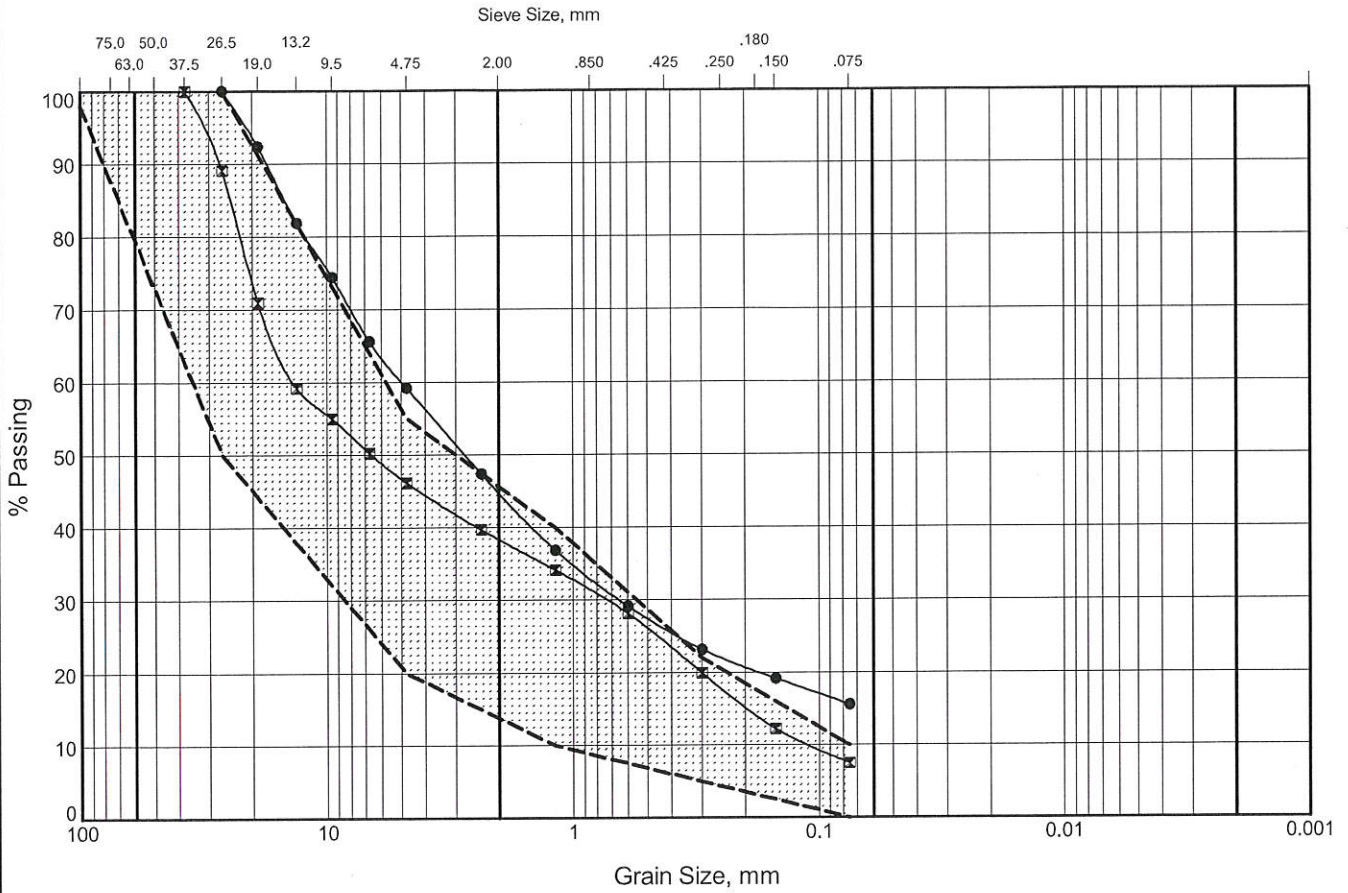


Date: November 2013

Project: 13-337

# GRAIN SIZE DISTRIBUTION

FIGURE 4



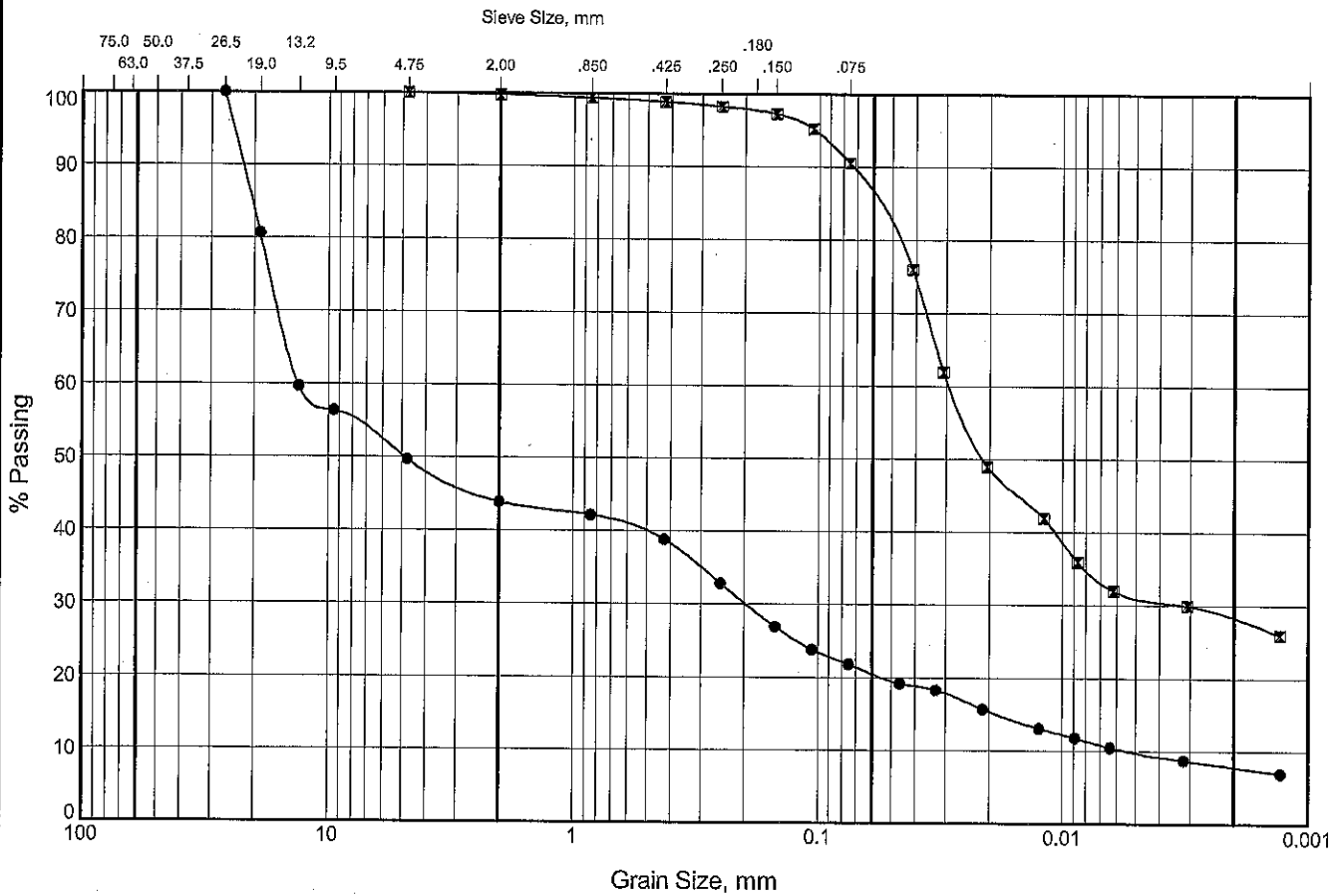
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	CLAY
	GRAVEL			SAND			SILT			
Modified M.I.T. Classification										

Borehole	Sample	Depth (m)	Legend
13-2	2	0.4 - 0.7	●
13-10	2	0.4 - 0.6	⊠

----- Gradation Envelope: OPSS 1010 - GRANULAR B TYPE II

# GRAIN SIZE DISTRIBUTION

## FIGURE 5



COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	CLAY
GRAVEL			SAND			SILT			
Modified M.I.T. Classification									

Borehole	Sample	Depth (m)	Legend
13-5	3	1.5 - 2.0	●
13-11	6	2.3 - 2.7	☒

SOILS GRAIN SIZE GRAPH GINT LOGS SEPTEMBER 3 2013.GPJ HOULE CHEVRIER FEB 9 2011.GDT 11/27/13



Date: November 2013

Project: 13-337

November 2013

Our ref: 13-337

APPENDIX A

LIST OF ABBREVIATIONS AND TERMINOLOGY  
RECORD OF BOREHOLE SHEETS

## LIST OF ABBREVIATIONS AND TERMINOLOGY

### SAMPLE TYPES

AS	auger sample
CS	chunk sample
DO	drive open
MS	manual sample
RC	rock core
ST	slotted tube
TO	thin-walled open Shelby tube
TP	thin-walled piston Shelby tube
WS	wash sample

### PENETRATION RESISTANCE

#### Standard Penetration Resistance, N

The number of blows by a 63.5 kg hammer dropped 760 millimetres required to drive a 50 mm drive open sampler for a distance of 300 mm. For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

#### Dynamic Penetration Resistance

The number of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.

#### WH

Sampler advanced by static weight of hammer and drill rods.

#### WR

Sampler advanced by static weight of drill rods.

#### PH

Sampler advanced by hydraulic pressure from drill rig.

#### PM

Sampler advanced by manual pressure.

### SOIL TESTS

C	consolidation test
H	hydrometer analysis
M	sieve analysis
MH	sieve and hydrometer analysis
U	unconfined compression test
Q	undrained triaxial test
V	field vane, undisturbed and remoulded shear strength

### SOIL DESCRIPTIONS

<u>Relative Density</u>	<u>'N' Value</u>
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

<u>Consistency</u>	<u>Undrained Shear Strength (kPa)</u>
--------------------	---------------------------------------

Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very Stiff	over 100

### LIST OF COMMON SYMBOLS

$c_u$	undrained shear strength
$e$	void ratio
$C_c$	compression index
$c_v$	coefficient of consolidation
$k$	coefficient of permeability
$I_p$	plasticity index
$n$	porosity
$u$	pore pressure
$w$	moisture content
$w_L$	liquid limit
$w_p$	plastic limit
$\phi^1$	effective angle of friction
$\gamma$	unit weight of soil
$\gamma^1$	unit weight of submerged soil
$\sigma$	normal stress



PROJECT: 13-337

# RECORD OF BOREHOLE 13-1


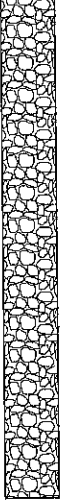
SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT	
								Cu, kPa	nat. V - + rem. V - ⊕			Q - ● U - ○	Wp
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.88							Cold Patch   Native Backfill   No groundwater observed on completion of borehole		
		ASPHALTIC CONCRETE		56.78 0.10									
		Grey sand and gravel, trace to some silt (BASE / SUBBASE MATERIAL)			1	CS							
		Dark grey silty clay, some sand, some gravel (FILL MATERIAL)			56.16 0.72	2	CS						
1		Brown sand and gravel, trace silt, trace clay (FILL MATERIAL)			55.79 1.09	3	50 D.O.	22					
	Auger refusal on inferred bedrock End of borehole			55.41 1.47									

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE  
1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.  
CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-2

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		nat. V - + Q - ● rem. V - ⊕ U - ○		Wp		W			WI
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.91													
		ASPHALTIC CONCRETE		56.81													Cold Patch
		Grey fine to coarse grained sand and gravel, some silt (BASE MATERIAL)		0.10	1	CS											
		Grey fine to coarse grained sand and gravel, some silt (SUBBASE MATERIAL)		0.38	2	CS											
		Brown sand and gravel, some silt (FILL MATERIAL)		0.74	3	CS											
1			Possible WEATHERED BEDROCK		1.27	4	50 D.O.	31									Native Backfill
		Auger refusal on inferred bedrock End of borehole		1.55												No groundwater observed on completion of borehole	

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-3



SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		nat. V - + Q - ● rem. V - ⊕ U - ○		Wp				W	
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.67											Cold Patch 		
		ASPHALTIC CONCRETE		56.61													
		Grey sand and gravel, trace silt (BASE / SUBBASE MATERIAL)		0.06		1	CS										
		Brown sand and gravel, some silt, trace clay, cobbles observed (FILL MATERIAL)		56.25 0.42		2	CS										
1		Dark grey silty clay, some gravel, trace sand (FILL MATERIAL)		55.98 0.69		3		50 D.O.	16						Native Backfill 		
	End of borehole		55.15 1.52											No groundwater observed on completion of borehole			
2																	
3																	
4																	

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-4

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		rem. V - ⊕		Wp		WI			
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.51													
		ASPHALTIC CONCRETE		56.41 0.10													Cold Patch
		Grey sand and gravel, some silt (BASE / SUBBASE MATERIAL)		58.09 0.42	1	CS											
		Brown sand and gravel, some silt, cobbles observed (FILL MATERIAL)		55.81 0.70	2	CS											
		Grey silty clay, some sand, trace gravel, trace roots and organic material (FILL MATERIAL)		55.09 1.42	3	50 D.O.	10										
		Auger refusal on inferred bedrock End of borehole															No groundwater observed on completion of borehole

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE  
1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.  
CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-5

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		nat. V - + Q - ●		rem. V - ⊕ U - ○		WATER CONTENT, PERCENT			
								20	40	60	80	20	40	60			80
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		57.12												Flush Mount  Bentonite  Filter Sand  51mm diameter, 0.91m long slotted PVC pipe  MH  Monitoring well dry on September 13, 2013	
		Dark brown, fine to medium grained sand, some silt, trace gravel, trace organic material (TOPSOIL FILL)		56.99 0.13	1	50 D.O.	9										
		Brown, fine to medium grained sand, some silt, trace gravel, occasional silty clay pocket (Possible FILL MATERIAL)				2	50 D.O.	11									
1		Dark brown sandy gravel, some silt, trace clay (Possible FILL MATERIAL)		55.60 1.52	3	50 D.O.	90 for 6.20m										
2		Auger refusal on inferred bedrock End of borehole		54.94 2.18													
3																	
4																	

BOREHOLE RECORD WITH LAB WC - GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-6

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, $k_v$ cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		rem. V - $\oplus$ U - $\circ$		Wp		WI			
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.25													
		ASPHALTIC CONCRETE		56.15													Cold Patch
		Grey sand and gravel, trace silt (BASE / SUBBASE MATERIAL)		0.10													
		Brown sand and gravel, some silt, trace clay (Possible FILL MATERIAL)		55.79 0.46	1	CS											
		Possible WEATHERED BEDROCK		55.44 0.81	2	CS											
1				55.44 0.81	3	50 D.O. for 0.20m											Native Backfill
		Auger refusal on inferred bedrock End of borehole		54.67 1.58													No groundwater observed on completion of borehole
2																	
3																	
4																	

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-7


SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		rem. V-ϕ		Wp		Wl			
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.57												Cold Patch	
		ASPHALTIC CONCRETE		56.47													
		Grey sand and gravel, trace silt (BASE / SUBBASE MATERIAL)		0.10	1	CS											
		Brown, fine to medium grained sand, some gravel, trace silt, cobbles observed (FILL MATERIAL)		56.21	0.36	2	CS										
	Brown sand and gravel, some silt, trace clay (FILL MATERIAL)		56.01	0.56	3	CS											
1				56.01	0.56											Native Backfill	
				55.05	1.52	4	50 D.O.	10									
		End of borehole														No groundwater observed on completion of borehole	
2																	
3																	
4																	

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ FCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-8

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		nat. V - + Q - ● rem. V - ⊕ U - ○		Wp		Wl			
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		58.77													
		ASPHALTIC CONCRETE		56.86													Cold Patch
		Grey sand and gravel, some silt (BASE / SUBBASE MATERIAL)		56.11	1	CS											
		Brown, fine to medium grained sand, trace silt, trace clay (FILL MATERIAL)		56.21													
				56.07	2	CS											
				56.07													
1			Brown to grey sand and gravel, trace to some silt, trace clay (Possible FILL MATERIAL)														
				55.25	3	50 D.O.	23										Native Backfill
		Brown, fine to medium grained sand, some gravel, trace silt (Possible FILL MATERIAL)															
			54.10	4	50 D.O.	13											
2			54.10														
		Possible WEATHERED BEDROCK															
			53.62	5	50 D.O.	31											
3			53.62														
		Auger refusal on inferred bedrock End of borehole															
			53.62	6	50 D.O.	50 for 0.0m										No groundwater observed on completion of borehole	

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE

1 to 20

**Houle Chevrier Engineering Ltd.**

LOGGED: A.N.

CHECKED:



PROJECT: 13-337

# RECORD OF BOREHOLE 13-9

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								Cu, kPa		rem. V - U -		Wp		Wl			
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.72											Cold Patch		
		ASPHALTIC CONCRETE		56.61													
		Grey sand and gravel, some silt (BASE / SUBBASE MATERIAL)		0.11	1	CS											
		Brown sand and gravel, trace silt (FILL MATERIAL)		0.56	2	CS											
1					3		50	18								Native Backfill	
		Brown clayey silt, some sand and gravel (FILL MATERIAL)		1.85	4		50	9									
		Grey brown SAND and GRAVEL, some silt		1.98	5		50	90									
		Possible WEATHERED BEDROCK		2.57													
	Auger refusal on inferred bedrock End of borehole		2.85											No groundwater observed on completion of borehole			

BOREHOLE RECORDED WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE  
1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.  
CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-10

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION				
		DESCRIPTION	STRATA PILOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa		nat. V - + Q - ●		rem. V - ⊕ U - ○				WATER CONTENT, PERCENT			
								20	40	60	80	20	40			60	80	Wp	W
0	Power Auger 200 mm Diameter Hollow Stem	Ground Surface		56.59															
		ASPHALTIC CONCRETE																	
			Brown, fine to coarse grained sand and gravel, trace silt (BASE MATERIAL)		56.42 0.17	1	CS												
			Dark grey sand and gravel, trace silt (SUBBASE MATERIAL)		56.20 0.39	2	CS												
			Dark grey brown clayey silt, some sand and gravel (Possible FILL MATERIAL)		55.99 0.60	3	CS												
1					4	50 D.O.	8												
		End of borehole		55.07 1.52															

BOREHOLE RECORD WITH LAB WC GINT LOGS SEPTEMBER 3 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

Cold Patch

Native Backfill

No groundwater observed on completion of borehole

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

PROJECT: 13-337

# RECORD OF BOREHOLE 13-11

SHEET 1 OF 1

LOCATION: See Borehole Location Plan Figure 2

DATUM: Geodetic

BORING DATE: September 3, 2013

SPT HAMMER: 63.5 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								20 40 60 80		nat. V - + Q - ●		rem. V - ⊕ U - ○				Wp	
0		Ground Surface		56.84											Flush Mount		
		ASPHALTIC CONCRETE		56.78													
		Grey sand and gravel, trace silt (BASE MATERIAL)		56.89	1	CS											
		Brown, fine to coarse grained sand, trace to some silt, some gravel, cobbles (SUBBASE MATERIAL)		56.59	2	CS											
		Grey brown sand and gravel, trace silt, trace clay (FILL MATERIAL)		56.23	3	CS											
		Brown, fine to medium grained SAND, trace silt (FILL MATERIAL)		55.96													
		Grey brown silty clay, some sand, some gravel (FILL MATERIAL)		55.81													
1		Brown sand and gravel, trace silt, cobbles observed (FILL MATERIAL)		55.32	4	50 D.O.	9										
		no sample recovery		54.71													
2	Power Auger 200 mm Diameter Hollow Stem			54.07	5	50 D.O.	15										
		Brown CLAYEY SILT, some sand		54.07	6	50 D.O.	4										
		Possible WEATHERED BEDROCK		53.05	7	50 D.O.	50 for 0.10m										
3				53.05													
4		Auger refusal on inferred bedrock End of borehole		53.05													

BOREHOLE RECORD WITH LAB W/C GINT LOGS SEPTEMBER 3, 2013.GPJ HCE DATA TEMPLATE.GDT 10/23/13

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

Flush Mount

Bentonite

Filter Sand

61mm diameter, 1.22m long slotted PVC pipe

MH, Corrosion

Bentonite

Monitoring well dry on September 13, 2013

November 2013

Our ref: 13-337

APPENDIX B

CHEMICAL TEST RESULTS ON GROUNDWATER  
SAMPLE RELATING TO CORROSION  
PARACEL LABORATORIES LTD.

## Certificate of Analysis

### Houle Chevrier

180 Wescar Lane  
Carp, ON K0A 1L0  
Attn: Brent Wiebe

Phone: (613) 836-1422  
Fax: (613) 836-9731

Client PO:  
Project: 13-337  
Custody:

Report Date: 23-Sep-2013  
Order Date: 18-Sep-2013

**Order #: 1338206**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

**Paracel ID**  
1338206-01

**Client ID**  
BH 13-11 - SA 6

Approved By:



Mark Foto, M.Sc. For Dale Robertson, BSc  
Laboratory Director

Any use of these results implies your agreement that our total liability in connection with this work, however arising shall be limited to the amount paid by you for this work, and that our employees or agents shall not under circumstances be liable to you in connection with this work

**Certificate of Analysis**

Client: Houle Chevrier  
Client PO:

Project Description: 13-337

Report Date: 23-Sep-2013  
Order Date: 18-Sep-2013

**Analysis Summary Table**

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	19-Sep-13	19-Sep-13
pH	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	18-Sep-13	19-Sep-13
Resistivity	EPA 120.1 - probe, water extraction	23-Sep-13	23-Sep-13
Solids, %	Gravimetric, calculation	19-Sep-13	19-Sep-13

P: 1-800-749-1947  
E: PARACEL@PARACELLABS.COM

WWW.PARACELLABS.COM

**OTTAWA**  
300-2319 St. Laurent Blvd.  
Ottawa, ON K1G 4J8

**MISSISSAUGA**  
8946 Kilomat Rd, Unit 927  
Mississauga, ON L5N 6J3

**NIAGARA FALLS**  
5415 Morning Glory Ct.  
Niagara Falls, ON L2J 0A3

**SARNIA**  
123 Christine St. N.  
Sarnia, ON N7T 5T7

**Certificate of Analysis**

Report Date: 23-Sep-2013

Order Date: 18-Sep-2013

Client: Houle Chevrier

Project Description: 13-337

Client PO:

Client ID:	BH 13-11 - SA 6	-	-	-
Sample Date:	03-Sep-13	-	-	-
Sample ID:	1338206-01	-	-	-
MDL/Units	Soil	-	-	-

**Physical Characteristics**

% Solids	0.1 % by Wt.	83.5	-	-	-
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**General Inorganics**

pH	0.05 pH Units	7.96	-	-	-
Resistivity	0.10 Ohm.m	5.15	-	-	-

**Anions**

Chloride	5 ug/g dry	976	-	-	-
Sulphate	5 ug/g dry	158	-	-	-

**Certificate of Analysis**

Client: Houle Chevrier  
Client PO:

Project Description: 13-337

Report Date: 23-Sep-2013  
Order Date: 18-Sep-2013

**Method Quality Control: Blank**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Anions</b>									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
<b>General Inorganics</b>									
Resistivity	ND	0.10	Ohm.m						



**Certificate of Analysis**

Report Date: 23-Sep-2013  
Order Date: 18-Sep-2013

Client: Houle Chevrier

Project Description: 13-337

Client PO:

**Method Quality Control: Duplicate**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Anions</b>									
Chloride	40.2	5	ug/g dry	41.5			3.2	20	
Sulphate	29.1	5	ug/g dry	28.3			2.9	20	
<b>General Inorganics</b>									
pH	7.88	0.05	pH Units	7.96			1.0	10	
Resistivity	5.09	0.10	Ohm.m	5.15			1.1	20	
<b>Physical Characteristics</b>									
% Solids	83.7	0.1	% by Wt.	80.3			4.2	25	

**Certificate of Analysis**

Client: Houle Chevrier  
Client PO:

Project Description: 13-337

Report Date: 23-Sep-2013  
Order Date: 18-Sep-2013

**Method Quality Control: Spike**

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
<b>Anions</b>									
Chloride	13.6		mg/L	4.1	94.8	78-113			
Sulphate	13.5		mg/L	2.83	107	78-111			

**Certificate of Analysis**

Report Date: 23-Sep-2013  
Order Date: 18-Sep-2013

Client: Houle Chevrier  
Client PO:

Project Description: 13-337

Qualifier Notes:

None

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.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.  
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

November 2013

Our ref: 13-337

APPENDIX C  
PREVIOUS INVESTIGATION  
BY HOULE CHEVRIER ENGINEERING LTD.  
RECORD OF BOREHOLE SHEETS

PROJECT: 12-032

# RECORD OF BOREHOLE 12-2

SHEET 1 OF 1

LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

BORING DATE: February 27, 2012

SPT HAMMER: 21.17 kg; drop 0.76 m

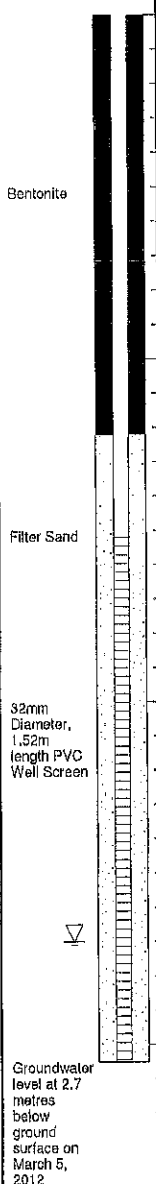
DEPTH SCALE METRES	BORING METHOD	ROCK PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, k, cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT					
								20 40 60 80		nat. V - + Q - ● rem. V - ⊗ U - ○		10 <sup>-7</sup> 10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup>		Wp   W   Wl 20 40 60 80			
0		Ground Surface		56.93													
		Dark brown sand, some silt, some organic material (TOPSOIL / FILL)															
				56.62 0.31	1	50 DO	5										
		Brown, fine to coarse grained sand, trace silt and gravel (FILL)															
					2	50 DO	5										
1				55.86 1.07													
		Gray brown silty clay, some gravel (POSSIBLE FILL)															
					3	50 DO	5										
				55.10 1.83													
2		Poor sample recovery Possible gravel fill or weathered/fractured limestone bedrock															
					4	50 DO	7										
					5	50 DO	23										
3				53.89 3.05													
		End of Borehole															

ROCK LOGS 2012 12-032 LOGS.GPJ HGE DATA TEMPLATE.GDT 28/3/12

DEPTH SCALE  
1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.  
CHECKED:



PROJECT: 12-092

# RECORD OF BOREHOLE 12-3

SHEET 1 OF 1

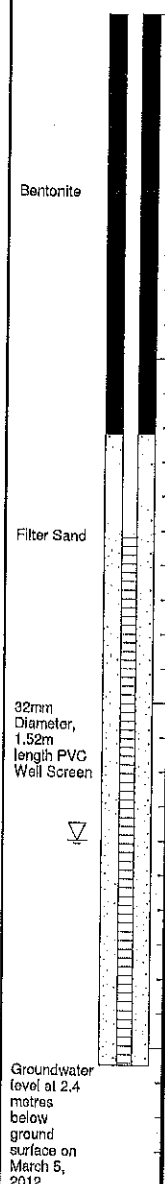
LOCATION: See Borehole Location Plan, Figure 2

DATUM: Geodetic

BORING DATE: February 27, 2012

SPT HAMMER: 21.17 kg; drop 0.76 m

DEPTH SCALE METRES	BORING METHOD	ROCK PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m				HYDRAULIC CONDUCTIVITY, $K_v$ cm/s				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	SHEAR STRENGTH				WATER CONTENT, PERCENT					
							20 40 60 80		20 40 60 80		10 <sup>-7</sup> 10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup>		20 40 60 80			
0		Ground Surface		56.89												
	Spill Spoon 50mm Diameter	Dark brown silty sand, some organic material (TOPSOIL / FILL)		56.69												
		Grey brown to brown sand and gravel, trace silt (FILL)		0.20												
	Rotary Diamond 75.88mm Diameter	Boulders (FILL)		56.20	1	50 DO	28	10	23m						Bentonite	
		Grey brown clayey sand and gravel, some silt (FILL)		1.22		2	RC									
1	Spill Spoon 50mm Diameter	Brown silty sand, some gravel and clay (FILL)		54.78	4	50 DO	12									
		Possible peat with wood (FILL)		54.65												
		Brown, fine to coarse grained sand, some gravel, silt, clay and trace wood fragments (FILL)		54.55		5	50 DO	8								
				2.34												
2																
3		Grey SILTY CLAY		53.89												
		End of Borehole		53.84												
				3.05												
4																



ROCK LOGS 2012 12-092 LOGS.GPJ HCE DATA TEMPLATE.GDT 28/3/12

DEPTH SCALE

1 to 20

Houle Chevrier Engineering Ltd.

LOGGED: A.N.

CHECKED:

Photographs showing the collapsed storm sewer at the steam tunnel crossing along the west side entrance near Sussex Drive.



Blocked Pipe Looking North



Blocked Pipe Looking North – Zoom



Blocked Pipe Looking South Toward Sussex



Blocked Pipe Looking South Toward Sussex - Zoomed





**TP1 Amount Payable – General**

1.1 Subject to any other provisions of the contract, Her Majesty shall pay the Contractor, at the times and in the manner hereinafter set out, the amount by which

1.1.1 the aggregate of the amounts described in TP2 exceeds

1.1.2 the aggregate of the amounts described in TP3

and the Contractor shall accept that amount as payment in full satisfaction for everything furnished and done by him in respect of the work to which the payment relates.

**TP2 Amounts Payable to the Contractor**

2.1 The amounts referred to in TP1.1.1 are the aggregate of

2.1.1 the amounts referred to in the Articles of Agreement, and

2.1.2 the amounts, if any, that are payable to the Contractor pursuant to the General Conditions.

**TP3 Amounts Payable to Her Majesty**

3.1 The amounts referred to in TP1.1.2 are the aggregate of the amounts, in any, that the Contractor is liable to pay Her Majesty pursuant to the contract.

3.2 When making any payments to the Contractor, the failure of Her Majesty to deduct an amount referred to in TP3.1 from an amount referred to in TP2 shall not constitute a waiver of the right to do so, or an admission of lack of entitlement to do so in any subsequent payment to the Contractor.

**TP4 Time of Payment**

4.1 In these Terms of Payment

4.1.1 The “payment period” means a period of 30 consecutive days or such other longer period as is agreed between the Contractor and the Departmental Representative.

4.1.2 An amount is “due and payable” when it is due and payable by Her Majesty to the Contractor according to TP4.4, TP4.7 or TP4.10.

4.1.3 An amount is overdue when it is unpaid on the first day following the day upon which it is due and payable.

4.1.4 The “date of payment” means the date of the negotiable instrument of an amount due and payable by the Receiver General for Canada and given for payment.

4.1.5 The “Bank Rate” means the discount rate of interest set by the Bank of Canada in effect at the opening of business on the date of payment.



- 4.2 The Contractor shall, on the expiration of a payment period, deliver to the Departmental Representative in respect of that payment period a written progress claim that fully describes any part of the work that has been completed, and any material that was delivered to the work site but not incorporated into the work during that payment period.
- 4.3 The Departmental Representative shall, not later than ten days after receipt by him of a progress claim referred to in TP4.2,
- 4.3.1 inspect the part of the work and the material described in the progress claim; and
- 4.3.2 issue a progress report, a copy of which the Departmental Representative will give to the Contractor, that indicates the value of the part of the work and the material described in the progress claim that, in the opinion of the Departmental Representative,
- 4.3.2.1 is in accordance with the contract, and
- 4.3.2.2 was not included in any other progress report relating to the contract.
- 4.4 Subject to TP1 and TP4.5 Her Majesty shall, not later than 30 days after receipt by the Departmental Representative of a progress claim referred to in TP4.2, pay the Contractor
- 4.4.1 an amount that is equal to 95% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has been furnished by the Contractor, or
- 4.4.2 an amount that is equal to 90% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has not been furnished by the Contractor.
- 4.5 It is a condition precedent to Her Majesty's obligation under TP4.4 that the Contractor has made and delivered to the Departmental Representative,
- 4.5.1 a statutory declaration described in TP4.6 in respect of a progress claim referred to in TP4.2,
- 4.5.2 in the case of the Contractor's first progress claim, a construction schedule in accordance with the relevant sections of the Specifications, and
- 4.5.3 if the requirement for a schedule is specified, an update of the said schedule at the times identified in the relevant sections of the Specifications.
- 4.6 A statutory declaration referred to in TP4.5 shall contain a deposition by the Contractor that
- 4.6.1 up to the date of the Contractor's progress claim, the Contractor has complied with all his lawful obligations with respect to the Labour Conditions; and
- 4.6.2 up to the date of the Contractor's immediately preceding progress claim, all lawful obligations of the Contractor to subcontractors and suppliers of material in respect of the



work under the contract have been fully discharged.

- 4.7 Subject to TP1 and TP4.8, Her Majesty shall, not later than 30 days after the date of issue of an Interim Certificate of Completion referred to in GC44.2, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.7.1 the sum of all payments that were made pursuant to TP4.4;
  - 4.7.2 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty or rectifying defects described in the Interim Certificate of Completion; and
  - 4.7.3 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty of completing the parts of the work described in the Interim Certificate of Completion other than the defects referred to in TP4.7.2.
- 4.8 It is a condition precedent to Her Majesty's obligation under TP4.7 that the Contractor has made and delivered to the Departmental Representative,
- 4.8.1 a statutory declaration described in TP4.9 in respect of an Interim Certificate of Completion referred to in GC44.2, and
  - 4.8.2 if so specified in the relevant sections of the Specifications, and update of the construction schedule referred to in TP4.5.2 and the updated schedule shall, in addition to the specified requirements, clearly show a detailed timetable that is acceptable to the Departmental Representative for the completion of any unfinished work and the correction of all defects.
- 4.9 A statutory declaration referred to in TP4.8 shall contain a deposition by the contractor that up to the date of the Interim Certificate of Completion the Contractor has
- 4.9.1 complied with all of the Contractor's lawful obligations with respect to the Labour Conditions;
  - 4.9.2 discharged all of the Contractor's lawful obligations to the subcontractors and suppliers of material in respect of the work under the contract; and
  - 4.9.3 discharged the Contractor's lawful obligations referred to in GC14.6.
- 4.10 Subject to TP1 and TP4.11, Her Majesty shall, not later than 60 days after the date of issue of a Final Certificate of Completion referred to in GC44.1, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.10.1 the sum of all payments that were made pursuant to TP4.4; and
  - 4.10.2 the sum of all payments that were made pursuant to TP4.7.
- 4.11 It is a condition precedent to Her Majesty's obligation under TP4.10 that the Contractor has made and delivered a statutory declaration described in TP4.12 to the Departmental Representative.



- 4.12 A statutory declaration referred to in TP4.11 shall, in addition to the depositions described in TP4.9, contain a deposition by the Contractor that all of the Contractor's lawful obligations and any lawful claims against the Contractor that arose out of the performance of the contract have been discharged and satisfied.

**TP5 Progress Report and Payment Thereunder Not Binding on Her Majesty**

- 5.1 Neither a progress report referred to in TP4.3 nor any payment made by Her Majesty pursuant to these Terms of Payment shall be construed as an admission by Her Majesty that the work, material or any part thereof is complete, is satisfactory or is in accordance with the contract.

**TP6 Delay in Making Payment**

- 6.1 Notwithstanding GC7 any delay by Her Majesty in making any payment when it is due pursuant to these Terms of Payment shall not be a breach of the contract by Her Majesty.
- 6.2 Her Majesty shall pay, without demand from the Contractor, simple interest at the Bank Rate plus 1 -1/4 per centum on any amount which is overdue pursuant to TP4.1.3, and the interest shall apply from and include the day such amount became overdue until the day prior to the date of payment except that
- 6.2.1 interest shall not be payable or paid unless the amount referred to in TP6.2 has been overdue for more than 15 days following
- 6.2.1.1 the date the said amount became due and payable, or
- 6.2.1.2 the receipt by the Departmental Representative of the Statutory Declaration referred to in TP4.5, TP4.8 or TP4.11,
- whichever is the later, and
- 6.6.2 interest shall not be payable or paid on overdue advance payments if any.

**TP7 Right of Set-off**

- 7.1 Without limiting any right of set-off or deduction given or implied by law or elsewhere in the contract, Her Majesty may set off any amount payable to Her Majesty by the Contractor under this contract or under any current contract against any amount payable to the Contractor under this contract.
- 7.2 For the purposes of TP7.1, "current contract" means a contract between Her Majesty and the Contractor
- 7.2.1 under which the Contractor has an undischarged obligation to perform or supply work, labour or material, or
- 7.2.2 in respect of which Her Majesty has, since the date of which the Articles of Agreement were made, exercised any right to take the work that is the subject of the contract out of the Contractor's hands.



**TP8 Payment in Event of Termination**

- 8.1 If the contract is terminated pursuant to GC41, Her Majesty shall pay the Contractor any amount that is lawfully due and payable to the Contractor as soon as is practicable under the circumstances.

**TP9 Interest on Settled Claims**

- 9.1 Her Majesty shall pay to the Contractor simple interest on the amount of a settled claim at an average Bank Rate plus 1 ¼ per centum from the date the settled claim was outstanding until the day prior to the date of payment.
- 9.2 For the purposes of TP9.1,
- 9.2.1 a claim is deemed to have been settled when an agreement in writing is signed by the Departmental Representative and the Contractor setting out the amount of the claim to be paid by Her Majesty and the items or work for which the said amount is to be paid.
- 9.2.2 an "average Bank Rate" means the discount rate of interest set by the Bank of Canada in effect at the end of each calendar month averaged over the period the settled claim was outstanding.
- 9.2.3 a settled claim is deemed to be outstanding from the day immediately following the date the said claim would have been due and payable under the contract had it not been disputed.
- 9.3 For the purposes of TP9 a claim means a disputed amount subject to negotiation between Her Majesty and the Contractor under the contract.



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## **GC1 Interpretation**

### **1.1 In the contract**

- 1.1.1 where reference is made to a part of the contract by means of numbers preceded by letters, the reference shall be construed to be a reference to the particular part of the contract that is identified by that combination of letters and numbers and to any other part of the contract referred to therein;
- 1.1.2 “contract” means the contract document referred to in the Articles of Agreement;
- 1.1.3 “contract security” means any security given by the Contractor to Her Majesty in accordance with the contract;
- 1.1.4 “Departmental Representative” means the officer or employee of Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract and is so designated in writing to the Contractor;
- 1.1.5 “material” includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work;
- 1.1.6 “Minister” includes a person acting for, or if the office is vacant, in place of the Minister and his successors in the office, and his or their lawful deputy and any of his or their representatives appointed for the purposes of the contract;
- 1.1.7 “person” includes, unless the context otherwise requires, a partnership, proprietorship, firm, joint venture, consortium and a corporation;
- 1.1.8 “plant” includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract;
- 1.1.9 “subcontractor” means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work;
- 1.1.10 “superintendent” means the employee of the Contractor who is designated by the Contractor to act pursuant to GC19;
- 1.1.11 “work includes, subject only to any express stipulation in the contract to the contrary, everything that is necessary to be done, furnished or delivered by the Contractor to perform the contract.

1.2 The headings in the contract documents, other than in the Plans and Specifications, form no part of the contract but are inserted for convenience of reference only.

1.3 In interpreting the contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.



- 1.4 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between
- 1.4.1 the Plans and Specifications, the Specifications govern;
  - 1.4.2 the Plans, the Plans drawn with the largest scale govern; and
  - 1.4.3 figured dimensions and scaled dimensions, the figured dimensions govern.

**GC2 Successors and Assigns**

- 2.1 The contract shall inure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

**GC3 Assignment of Contract**

- 3.1 The contract may not be assigned by the Contractor, either in whole or in part, without the written consent of the Minister.

**GC4 Subcontracting by Contractor**

- 4.1 Subject to this General Condition, the Contractor may subcontract any part of the work.
- 4.2 The Contractor shall notify the Departmental Representative in writing of his intention to subcontract.
- 4.3 A notification referred to in GC4.2 shall identify the part of the work, and the subcontractor with whom it is intended to subcontract.
- 4.4 The Departmental Representative may object to the intended subcontracting by notifying the Contractor in writing within six days of receipt by the Departmental Representative of a notification referred to in GC4.2.
- 4.5 If the Departmental Representative objects to a subcontracting pursuant to GC4.4, the Contractor shall not enter into the intended subcontract.
- 4.6 The contractor shall not, without the written consent of the Departmental Representative, change a subcontractor who has been engaged by him in accordance with this General Condition.
- 4.7 Every subcontract entered into by the Contractor shall adopt all of the terms and conditions of this contract that are of general application.
- 4.8 Neither a subcontracting nor the Departmental Representative's consent to a subcontracting by the Contractor shall be construed to relieve the Contractor from any obligation under the contract or to impose any liability upon Her Majesty.

**GC5 Amendments**





- 5.1 No amendment or change in any of the provisions of the contract shall have any force or effect until it is reduced to writing.

**GC6 No Implied Obligations**

- 6.1 No implied terms or obligations of any kind by or on behalf of Her Majesty shall arise from anything in the contract and the express covenants and agreements therein contained and made by Her Majesty are the only covenants and agreements upon which any rights against Her Majesty are to be founded.
- 6.2 The contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work that were made prior to the date of the contract.

**GC7 Time of Essence**

- 7.1 Time is of the essence of the contract.

**GC8 Indemnification by Contractor**

- 8.1 The Contractor shall indemnify and save Her Majesty harmless from and against all claims, demand, losses, costs, damages, actions, suits, or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor, his servants, agents, subcontractors and sub-subcontractors in performing the work including an infringement or an alleged infringement of a patent of invention or any other kind of intellectual property.
- 8.2 For the purpose of GC8.1, "activities" includes any act improperly carried out, any omission to carry out an act and any delay in carrying out an act.

**GC9 Indemnification by Her Majesty**

- 9.1 Her Majesty shall, subject to the Crown Liability Act, the Patent Act, and any other law that affects Her Majesty's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract that are directly attributable to
- 9.1.1 lack of or a defect in Her Majesty's title to the work site whether real or alleged; or
- 9.1.2 an infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of the contract employing a model, plan or design or any other thing related to the work that was supplied by Her Majesty to the Contractor.

**GC10 Members of House of Commons Not to Benefit**



- 10.1 As required by the Parliament of Canada Act, it is an express condition of the contract that no member of the House of Commons shall be admitted to any share of part of the contract or to any benefit arising therefrom.

### **GC11 Notices**

- 11.1 Any notice, consent, order, decision, direction or other communication, other than a notice referred to in GC11.4, that may be given to the Contractor pursuant to the contract may be given in any manner.
- 11.2 Any notice, consent, order, decision, direction or other communication required to be given in writing, to any party pursuant to the contract shall, subject to GC11.4, be deemed to have been effectively given
- 11.2.1 to the Contractor, if delivered personally to the Contractor or the Contractor's superintendent, or forwarded by mail, telex or facsimile to the Contractor at the address set out in A4.1, or
- 11.2.2 to Her Majesty, if delivered personally to the Departmental Representative, or forwarded by mail, telex or facsimile to the Departmental Representative at the address set out in A1.2.1.
- 11.3 Any such notice, consent, order, decision, direction or other communication given in accordance with GC11.2 shall be deemed to have been received by either party
- 11.3.1 if delivered personally, on the day that it was delivered,
- 11.3.2 if forwarded by mail, on the earlier of the day it was received and the sixth day after it was mailed, and
- 11.3.3 if forwarded by telex or facsimile, 24 hours after it was transmitted.
- 11.4 A notice given under GC38.1.1, GC40 and GC41, if delivered personally, shall be delivered to the Contractor if the Contractor is doing business as sole proprietor or, if the Contractor is a partnership or corporation, to an officer thereof.

### **GC12 Material, Plant and Real Property Supplied by Her Majesty**

- 12.1 Subject to GC12.2, the Contractor is liable to Her Majesty for any loss of or damage to material, plant or real property that is supplied or placed in the care, custody and control of the Contractor by Her Majesty for use in connection with the contract, whether or not that loss or damage is attributable to causes beyond the Contractor's control.
- 12.2 The Contractor is not liable to Her Majesty for any loss or damage to material, plant or real property referred to in GC12.1 if that loss or damage results from and is directly attributable to reasonable wear and tear.
- 12.3 The Contractor shall not use any material, plant or real property referred to in GC12.1 except for



the purpose of performing this contract.

- 12.4 When the Contractor fails to make good any loss or damage for which he is liable under GC12.1 within a reasonable time after being required to do so by the Departmental Representative, the Departmental Representative may cause the loss or damage to be made good at the Contractor's expense, and the Contractor shall thereupon be liable to Her Majesty for the cost thereof and shall, on demand, pay to Her Majesty an amount equal to that cost.
- 12.5 The Contractor shall keep such records of all material, plant and real property referred to in GC12.1 as the Departmental Representative from time to time requires and shall satisfy the Departmental Representative, when requested, that such material, plant and real property are at the place and in the condition which they ought to be.

### **GC13 Material, Plant and Real Property Become Property of Her Majesty**

- 13.1 Subject to GC14.7 all material and plant and the interest of the Contractor in all real property, licenses, powers and privileges purchased, used or consumed by the Contractor for the contract shall, after the time of their purchase, use or consumption be the property of Her Majesty for the purposes of the work and they shall continue to be the property of Her Majesty.
- 13.1.1 in the case of material, until the Departmental Representative indicates that he is satisfied that it will not be required for the work, and
- 13.1.2 in the case of plant, real property, licenses, powers and privileges, until the Departmental Representative indicates that he is satisfied that the interest vested in Her Majesty therein is no longer required for the purposes of the work.
- 13.2 Material or plant that is the property of Her Majesty by virtue of GC13.1 shall not be taken away from the work site or used or disposed of except for the purposes of the work without the written consent of the Departmental Representative.
- 13.3 Her Majesty is not liable for loss of or damage from any cause to the material or plant referred to in GC13.1 and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of Her Majesty.

### **GC14 Permits and Taxes Payable**

- 14.1 The Contractor shall, within 30 days after the date of the contract, tender to a municipal authority an amount equal to all fees and charges that would be lawfully payable to that municipal authority in respect of building permits as if the work were being performed for a person other than Her Majesty.
- 14.2 Within 10 days of making a tender pursuant to GC14.1, the Contractor shall notify the Departmental Representative of his action and of the amount tendered and whether or not the municipal authority has accepted that amount.
- 14.3 If the municipal authority does not accept the amount tendered pursuant to GC14.1 the Contractor shall pay that amount to Her Majesty within 6 days after the time stipulated in GC14.2.



- 14.4 For the purposes of GC14.1 to GC14.3 “municipal authority” means any authority that would have jurisdiction respecting permission to perform the work if the owner were not Her Majesty.
- 14.5 Notwithstanding the residency of the Contractor, the Contractor shall pay any applicable tax arising from or related to the performance of the work under the contract.
- 14.6 In accordance with the Statutory Declaration referred to in TP4.9, a Contractor who has neither residence nor place of business in the province in which work under the contract is being performed shall provide Her Majesty with proof of registration with the provincial sales tax authorities in the said province.
- 14.7 For the purpose of the payment of any applicable tax or the furnishing of security for the payment of any applicable tax arising from or related to the performance of the work under the contract, the Contractor shall, notwithstanding the fact that all material, plant and interest of the Contractor in all real property, licenses, powers and privileges, have become the property of Her Majesty after the time of purchase, be liable, as a user or consumer, for the payment or for the furnishing of security for the payment of any applicable tax payable, at the time of the use or consumption of that material, plant or interest of the Contractor in accordance with the relevant legislation.

#### **GC15 Performance of Work under Direction of Departmental Representative**

- 15.1 The Contractor shall
- 15.1.1 permit the Departmental Representative to have access to the work and its site at all times during the performance of the contract;
  - 15.1.2 furnish the Departmental Representative with such information respecting the performance of the contract as he may require; and
  - 15.1.3 give the Departmental Representative every possible assistance to enable the Departmental Representative to carry out his duty to see that the work is performed in accordance with the contract and to carry out any other duties and exercise any powers specially imposed or conferred on the Departmental Representative under the contract.

#### **CG16 Cooperation with Other Contractors**

- 16.1 Where, in the opinion of the Departmental Representative, it is necessary that other contractors or workers with or without plant and material, be sent onto the work or its site, the Contractor shall, to the satisfaction of the Departmental Representative, allow them access and cooperate with them in the carrying out of their duties and obligation.
- 16.2 If
- 16.2.1 the sending onto the work or its site of other contractors or workers pursuant to GC16.1 could not have been reasonably foreseen or anticipated by the Contractor when entering into the contract, and



16.2.2 the Contractor incurs, in the opinion of the Departmental Representative, extra expense in complying with GC16.1, and

16.2.3 The Contractor has given the Departmental Representative written notice of his claim for the extra expense referred to in GC16.2.2 within 30 days of the date that the other contractors or workers were sent onto the work or its site,

Her Majesty shall pay the Contractor the cost, calculated in accordance with GC48 to GC50, of the extra labour, plant and material that was necessarily incurred.

### **GC17 Examination of Work**

17.1 If, at any time after the commencement of the work but prior to the expiry of the warranty or guarantee period, the Departmental Representative has reason to believe that the work or any part thereof has not been performed in accordance with the contract, the Departmental Representative may have that work examined by an expert of his choice.

17.2 If, as a result of an examination of the work referred to in GC17.1, it is established that the work was not performed in accordance with the contract, then, in addition to and without limiting or otherwise affecting any of Her Majesty's rights and remedies under the contract either at law or in equity, the Contractor shall pay Her Majesty, on demand, all reasonable costs and expenses that were incurred by Her Majesty in having that examination performed.

### **GC18 Clearing of Site**

18.1 The Contractor shall maintain the work and its site in a tidy condition and free from the accumulation of waste material and debris, in accordance with any directions of the Departmental Representative.

18.2 Before the issue of an interim certificate referred to in GC44.2, the Contractor shall remove all the plant and material not required for the performance of the remaining work, and all waste material and other debris, and shall cause the work and its site to be clean and suitable for occupancy by Her Majesty's servants, unless otherwise stipulated in the contract.

18.3 Before the issue of a final certificate referred to in GC44.1, the Contractor, shall remove from the work and its site all of the surplus plant and material and any waste material and other debris.

18.4 The Contractor's obligations described in GC18.1 to GC18.3 do not extend to waste material and other debris caused by Her Majesty's servants or contractors and workers referred to in GC16.1.

### **GC19 Contractor's Superintendent**

19.1 The Contractor shall, forthwith upon the award of the contract, designate a superintendent.

19.2 The Contractor shall forthwith notify the Departmental Representative of the name, address and telephone number of a superintendent designate pursuant to GC19.1.



- 19.3 A superintendent designated pursuant to GC19.1 shall be in full charge of the operations of the Contractor in the performance of the work and is authorized to accept any notice, consent, order, direction, decision or other communication on behalf of the Contractor that may be given to the superintendent under the contract.
- 19.4 The Contractor shall, until the work has been completed, keep a competent superintendent at the work site during working hours.
- 19.5 The Contractor shall, upon the request of the Departmental Representative, remove any superintendent who, in the opinion of the Departmental Representative, is incompetent or has been conducting himself improperly and shall forthwith designate another superintendent who is acceptable to the Departmental Representative.
- 19.6 Subject to GC19.5, the Contractor shall not substitute a superintendent without the written consent of the Departmental Representative.
- 19.7 A breach by the Contractor of GC19.6 entitles the Departmental Representative to refuse to issue any certificate referred to in GC44 until the superintendent has returned to the work site or another superintendent who is acceptable to the Departmental Representative has been substituted.

#### **GC20 National Security**

- 20.1 If the Minister is of the opinion that the work is of a class or kind that involves the national security, he may order the Contractor
- 20.1.1 to provide him with any information concerning persons employed or to be employed by him for purposes of the contract; and
  - 20.1.2 to remove any person from the work and its site if, in the opinion of the Minister, that person may be a risk to the national security.
- 20.2 The Contractor shall, in all contracts with persons who are to be employed in the performance of the contract, make provision for his performance of any obligation that may be imposed upon him under GC19 to GC21.
- 20.3 The Contractor shall comply with an order of the Minister under GC20.1

#### **GC21 Unsuitable Workers**

- 21.1 The Contractor shall, upon the request of the Departmental Representative, remove any person employed by him for purposes of the contract who, in the opinion of the Departmental Representative, is incompetent or has conducted himself improperly, and the Contractor shall not permit a person who has been removed to return to the work site.

#### **GC22 Increased or Decreased Costs**



- 22.1 The amount set out in the Articles of Agreement shall not be increased or decreased by reason of any increase or decrease in the cost of the work that is brought about by an increase or decrease in the cost of labour, plant or material or any wage adjustment arising pursuant to the Labour Conditions.
- 22.2 Notwithstanding GC22.1 and GC35, an amount set out in the Articles of Agreement shall be adjusted in the manner provided in GC22.3, if any change in a tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property
- 22.2.1 occurs after the date of the submission by the Contractor of his tender for the contract,
- 22.2.2 applies to material, and
- 22.2.3 affects the cost to the Contractor of that material.
- 22.3 If a change referred to in GC22.2 occurs, the appropriate amount set out in the Articles of Agreement shall be increased or decreased by an amount equal to the amount that is established by an examination of the relevant records of the Contractor referred to in GC51 to be the increase or decrease in the cost incurred that is directly attributable to that change.
- 22.4 For the purpose of GC22.2, where a tax is changed after the date of submission of the tender but public notice of the change has been given by the Minister of Finance before that date, the change shall be deemed to have occurred before the date of submission of the tender.

### **GC23 Canadian Labour and Material**

- 23.1 The Contractor shall use Canadian labour and material in the performance of the work to the full extent to which they are procurable, consistent with proper economy and expeditious carrying out of the work.
- 23.2 Subject to GC23.1, the Contractor shall, in the performance of the work, employ labour from the locality where the work is being performed to the extent to which it is available, and shall use the offices of the Canada Employment Centres for the recruitment of workers wherever practicable.
- 23.3 Subject to GC23.1 and GC23.2, the Contractor shall, in the performance of the work, employ a reasonable proportion of persons who have been on active service with the armed forces of Canada and have been honourably discharged therefrom.

### **GC24 Protection of Work and Documents**

- 24.1 The Contractor shall guard or otherwise protect the work and its site, and protect the contract, specifications, plans, drawings, information, material, plant and real property, whether or not they are supplied by Her Majesty to the Contractor, against loss or damage from any cause, and he shall not use, issue, disclose or dispose of them without the written consent of the Minister, except as may be essential for the performance of the work.



- 24.2 If any document or information given or disclosed to the Contractor is assigned a security rating by the person who gave or disclosed it, the Contractor shall take all measures directed by the Departmental Representative to be taken to ensure the maintenance of the degree of security that is ascribed to that rating.
- 24.3 The Contractor shall provide all facilities necessary for the purpose of maintaining security, and shall assist any person authorized by the Minister to inspect or to take security measures in respect of the work and its site.
- 24.4 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure compliance with or to remedy a breach of GC24.1 to GC24.3.

### **GC25 Public Ceremonies and Signs**

- 25.1 The Contractor shall not permit any public ceremony in connection with the work without the prior consent of the Minister.
- 25.2 The Contractor shall not erect or permit the erection of any sign or advertising on the work or its site without the prior consent of the Departmental Representative.

### **GC26 Precautions against Damage, Infringement of Rights, Fire, and Other Hazards**

- 26.1 The Contractor shall, at his own expense, do whatever is necessary to ensure that
- 26.1.1 no person, property, right, easement or privilege is injured, damaged or infringed by reasons of the Contractor's activities in performing the contract;
  - 26.1.2 pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the work or plant;
  - 26.1.3 fire hazards in or about the work or its site are eliminated and, subject to any direction that may be given by the Departmental Representative, any fire is promptly extinguished;
  - 26.1.4 the health and safety of all persons employed in the performance of the work is not endangered by the method or means of its performance;
  - 26.1.5 adequate medical services are available to all persons employed on the work or its site at all times during the performance of the work;
  - 26.1.6 adequate sanitation measures are taken in respect of the work and its site; and
  - 26.1.7 all stakes, buoys and marks placed on the work or its site by or under the authority of the Departmental Representative are protected and are not removed, defaced, altered or destroyed.
- 26.2 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure





compliance with or to remedy a breach of GC26.1.

- 26.3 The Contractor shall, at his own expense, comply with a direction of the Departmental Representative made under GC26.2.

#### **GC27 Insurance**

- 27.1 The Contractor shall, at his own expense, obtain and maintain insurance contracts in respect of the work and shall provide evidence thereof to the Departmental Representative in accordance with the requirements of the Insurance Conditions "E".

- 27.2 The insurance contracts referred to in GC27.1 shall

27.2.1 be in a form, of the nature, in the amounts, for the periods and containing the terms and conditions specified in Insurance Conditions "E", and

27.2.2 provide for the payment of claims under such insurance contracts in accordance with GC28.

#### **GC28 Insurance Proceeds**

- 28.1 In the case of a claim payable under a Builders Risk/Installation (All Risks) insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid directly to Her Majesty, and

28.1.1 the monies so paid shall be held by Her Majesty for the purposes of the contract, or

28.1.2 if Her Majesty elects, shall be retained by Her Majesty, in which event they vest in Her Majesty absolutely.

- 28.2 In the case of a claim payable under a General Liability insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid by the insurer directly to the claimant.

- 28.3 If an election is made pursuant to GC28.1, the Minister may cause an audit to be made of the accounts of the Contractor and of Her Majesty in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between

28.3.1 the aggregate of the amount of the loss or damage suffered or sustained by Her Majesty, including any cost incurred in respect of the clearing and cleaning of the work and its site and any other amount that is payable by the Contractor to Her Majesty under the contract, minus any monies retained pursuant to GC28.12, and

28.3.2 the aggregate of the amounts payable by Her Majesty to the Contractor pursuant to the contract up to the date of the loss or damage.

- 28.4 A difference that is established pursuant to GC28.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the



creditor.

- 28.5 When payment of a deficiency has been made pursuant to GC28.4, all rights and obligations of Her Majesty and the Contractor under the contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC28.3, be deemed to have been expended and discharged.
- 28.6 If an election is not made pursuant to GC28.1.2 the Contractor shall, subject to GC28.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at his own expense as if that part of the work had not yet been performed.
- 28.7 When the Contractor clears and cleans the work and its site and restores and replaces the work referred to in GC 28.6, Her Majesty shall pay him out of the monies referred to in GC28.1 so far as they will thereunto extend.
- 28.8 Subject to GC28.7, payment by Her Majesty pursuant to GC28.7 shall be made in accordance with the contract but the amount of each payment shall be 100% of the amount claimed notwithstanding TP4.4.1 and TP4.4.2.

### **GC29 Contract Security**

- 29.1 The Contractor shall obtain and deliver contract security to the Departmental Representative in accordance with the provisions of the Contract Security Conditions.
- 29.2 If the whole or a part of the contract security referred to in GC29.1 is in the form of a security deposit, it shall be held and disposed of in accordance with GC43 and GC45.
- 29.3 If a part of the contract security referred to in GC29.1 is in the form of a labour and material payment bond, the Contractor shall post a copy of that bond on the work site.

### **GC30 Changes in the Work**

- 30.1 Subject to GC5, the Departmental Representative may, at any time before he issues his Final Certificate of Completion,
- 30.1.1 order work or material in addition to that provided for in the Plans and Specifications;  
and
- 30.1.2 delete or change the dimensions, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications or in any order made pursuant to GC30.1.1,
- if that additional work or material, deletion, or change is, in his opinion, consistent with the general intent of the original contract.
- 30.2 The Contractor shall perform the work in accordance with such orders, deletions and changes that are made by the Departmental Representative pursuant to GC30.1 from time to time as if they had appeared in and been part of the Plans and Specifications.



- 30.3 The Departmental Representative shall determine whether or not anything done or omitted by the Contractor pursuant to an order, deletion or change referred to in GC30.1 increased or decreased the cost of the work to the Contractor.
- 30.4 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been increased, Her Majesty shall pay the Contractor the increased cost that the Contractor necessarily incurred for the additional work calculated in accordance with GC49 or GC50.
- 30.5 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been decreased, Her Majesty shall reduce the amount payable to the Contractor under the contract by an amount equal to the decrease in the cost caused by the deletion or change referred to in GC30.1.2 and calculated in accordance with GC49.
- 30.6 GC30.3 to GC30.5 are applicable only to a contract or a portion of a contract for which a Fixed Price Arrangement is stipulated in the contract.
- 30.7 An order, deletion or change referred to in GC30.1 shall be in writing, signed by the Departmental Representative and given to the Contractor in accordance with GC11.

### **GC31 Interpretation of Contract by Departmental Representative**

- 31.1 If, at any time before the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, any question arises between the parties about whether anything has been done as required by the contract or about what the Contractor is required by the contract to do, and, in particular but without limiting the generality of the foregoing, about
- 31.1.1 the meaning of anything in the Plans and Specification,
  - 31.1.2 the meaning to be given to the Plans and Specifications in case of any error therein, omission therefrom, or obscurity or discrepancy in their working or intention,
  - 31.1.3 whether or not the quality or quantity of any material or workmanship supplied or proposed to be supplied by the Contractor meets the requirements of the contract,
  - 31.1.4 whether or not the labour, plant or material provided by the Contractor for performing the work and carrying out the contract are adequate to ensure that the work will be performed in accordance with the contract and that the contract will be carried out in accordance with its terms,
  - 31.1.5 what quantity of any kind of work has been completed by the Contractor, or
  - 31.1.6 the timing and scheduling of the various phases of the performance of the work,
- the question shall be decided by the Departmental Representative whose decision shall be final and conclusive in respect of the work.
- 31.2 The Contractor shall perform the work in accordance with any decisions of the Departmental



Representative that are made under GC31.1 and in accordance with any consequential directions given by the Departmental Representative.

### **GC32 Warranty and Rectification of Defects in Work**

- 32.1 Without restricting any warranty or guarantee implied or imposed by law or contained in the contract documents, the Contractor shall, at his own expense,
- 32.1.1 rectify and make good any defect or fault that appears in the work or comes to the attention of the Minister with respect to those parts of the work accepted in connection with the Interim Certificate of Completion referred to GC44.2 within 12 months from the date of the Interim Certificate of Completion;
- 32.1.2 rectify and make good any defect or fault that appears in or comes to the attention of the Minister in connection with those parts of the work described in the Interim Certificate of Completion referred to in GC44.2 within 12 months from the date of the Final Certificate of Completion referred to in GC44.1.
- 32.2 The Departmental Representative may direct the Contractor to rectify and make good any defect or fault referred to in GC32.1 or covered by any other expressed or implied warranty or guarantee.
- 32.3 A direction referred to in GC32.2 shall be in writing, may include a stipulation in respect of the time within which a defect or fault is required to be rectified and made good by the Contractor, and shall be given to the Contractor in accordance with GC11.
- 32.4 The Contractor shall rectify and make good any defect or fault described in a direction given pursuant to GC32.2 within the time stipulated therein.

### **GC33 Non-Compliance by Contractor**

- 33.1 If the Contractor fails to comply with any decision or direction given by the Departmental Representative pursuant to GC18, GC24, GC26, GC31 or GC32, the Departmental Representative may employ such methods as he deems advisable to do that which the Contractor failed to do.
- 33.2 The Contractor shall, on demand, pay Her Majesty an amount that is equal to the aggregate of all cost, expenses and damage incurred or sustained by Her Majesty by reason of the Contractor's failure to comply with any decision or direction referred to in GC33.1, including the cost of any methods employed by the Departmental Representative pursuant to GC33.1.

### **GC34 Protesting Departmental Representative's Decisions**

- 34.1 The Contractor may, within ten days after the communication to him of any decision or direction referred to in GC30.3 or GC33.1, protest that decision or direction.
- 34.2 A protest referred to in GC34.1 shall be in writing, contain full reasons for the protest, be signed



by the Contractor and be given to Her Majesty by delivery to the Departmental Representative.

- 34.3 If the Contractor gives a protest pursuant to GC34.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction, or prevent the Contractor from taking whatever action he considers appropriate in the circumstances.
- 34.4 The giving of a protest by the Contractor pursuant to GC34.2 shall not relieve him from complying with the decision or direction that is the subject of the protest.
- 34.5 Subject to GC34.6, the Contractor shall take any action referred to in GC34.3 within three months after the date that a Final Certificate of Completion is issued under GC44.1 and not afterwards.
- 34.6 The Contractor shall take any action referred to in GC34.3 resulting from a direction under GC32 within three months after the expiry of a warranty or guarantee period and not afterwards.
- 34.7 Subject to GC34.8, if Her Majesty determines that the Contractor's protest is justified, Her Majesty shall pay the Contractor the cost of the additional labour, plant and material necessarily incurred by the Contractor in carrying out the protested decision or direction.
- 34.8 Costs referred to in GC34.7 shall be calculated in accordance with GC48 to GC50.

### **GC35 Changes in Soil Conditions and Neglect or Delay by Her Majesty**

35.1 Subject to GC35.2 no payment, other than a payment that is expressly stipulated in the contract, shall be made by Her Majesty to the Contractor for any extra expense or any loss or damage incurred or sustained by the Contractor.

35.2 If the Contractor incurs or sustains any extra expense or any loss or damage that is directly attributable to

35.2.1 a substantial difference between the information relating to soil conditions at the work site that is contained in the Plans and Specifications or other documents supplied to the Contractor for his use in preparing his tender or a reasonable assumption of fact based thereon made by the Contractor, and the actual soil conditions encountered by the Contractor at the work site during the performance of the contract, or

35.2.2 any neglect or delay that occurs after the date of the contract on the part of Her Majesty in providing any information or in doing any act that the contract either expressly requires Her Majesty to do or that would ordinarily be done by an owner in accordance with the usage of the trade,

he shall, within ten days of the date the actual soil conditions described in GC35.2.1 were encountered or the neglect or delay described in GC35.2.2 occurred, give the Departmental Representative written notice of his intention to claim for that extra expense or that loss or damage.

35.3 When the Contractor has given a notice referred to in GC35.2, he shall give the Departmental Representative a written claim for extra expense or loss or damage within 30 days of the date that



a Final Certificate of Completion referred to in GC44.1 is issued and not afterwards.

- 35.4 A written claim referred to in GC35.3 shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the claim to enable the Departmental Representative to determine whether or not the claim is justified and the Contractor shall supply such further and other information for that purpose as the Departmental Representative requires from time to time.
- 35.5 If the Departmental Representative determines that a claim referred to in GC35.3 is justified, Her Majesty shall make an extra payment to the Contractor in an amount that is calculated in accordance with GC47 to GC50.
- 35.6 If, in the opinion of the Departmental Representative, an occurrence described in GC35.2.1 results in a savings of expenditure by the Contractor in performing the contract, the amount set out in the Articles of Agreement shall, subject to GC35.7, be reduced by an amount that is equal to the saving.
- 35.7 The amount of the saving referred to in GC35.6 shall be determined in accordance with GC47 to GC49.
- 35.8 If the Contractor fails to give a notice referred to in GC35.2 and a claim referred to in GC35.3 within the times stipulated, an extra payment shall not be made to him in respect of the occurrence.

### **GC36 Extension of Time**

- 36.1 Subject to GC36.2, the Departmental Representative may, on the application of the Contractor made before the day fixed by the Articles of Agreement for completion of the work or before any other date previously fixed under this General Condition, extend the time for its completion by fixing a new date if, in the opinion of the Departmental Representative, causes beyond the control of the Contractor have delayed its completion.
- 36.2 An application referred to in GC36.1 shall be accompanied by the written consent of the bonding company whose bond forms part of the contract security.

### **GC37 Assessments and Damages for Late Completion**

- 37.1 For the purposes of this General Condition
- 37.1.1 the work shall be deemed to be completed on the date that an Interim Certificate of Completion referred to in GC44.2 is issued, and
- 37.1.2 "period of delay" means the number of days commencing on the day fixed by the Articles of Agreement for completion of the work and ending on the day immediately preceding the day on which the work is completed but does not include any day within a period of extension granted pursuant to GC36.1, and any other day on which, in the opinion of the Departmental Representative, completion of the work was delayed for reasons beyond the control of the Contractor.



- 37.2 If the Contractor does not complete the work by the day fixed for its completion by the Articles of Agreement but completes it thereafter, the Contractor shall pay Her Majesty an amount equal to the aggregate of
- 37.2.1 all salaries, wages and travelling expenses incurred by Her Majesty in respect of persons overseeing the performance of the work during the period of delay;
  - 37.2.2 the cost incurred by Her Majesty as a result of the inability to use the completed work for the period of delay; and
  - 37.2.3 all other expenses and damages incurred or sustained by Her Majesty during the period of delay as a result of the work not being completed by the day fixed for its completion.
- 37.3 The Minister may waive the right of Her Majesty to the whole or any part of the amount payable by the Contractor pursuant to GC37.2 I, in the opinion of the Minister, it is in the public interest to do so.

#### **GC38 Taking the Work Out of the Contractor's Hands**

- 38.1 The Minister may, at his sole discretion, by giving a notice in writing to the Contractor in accordance with GC11, take all or any part of the work out of the Contractor's hands, and may employ such means as he sees fit to have the work completed if the Contractor
- 38.1.1 Has not, within six days of the Minister or the Departmental Representative giving notice to the Contractor in writing in accordance with GC11, remedied any delay in the commencement or any default in the diligent performance of the work to the satisfaction of the Departmental Representative;
  - 38.1.2 has defaulted in the completion of any part of the work within the time fixed for its completion by the contract;
  - 38.1.3 has become insolvent;
  - 38.1.4 has committed an act of bankruptcy;
  - 38.1.5 has abandoned the work;
  - 38.1.6 has made an assignment of the contract without the consent required by GC3.1; or
  - 38.1.7 has otherwise failed to observe or perform any of the provisions of the contract.
- 38.2 If the whole or any part of the work is taken out of the Contractor's hands pursuant to GC38.1,
- 38.2.1 the Contractor's right to any further payment that is due or accruing due under the contract is, subject only to GC38.4, extinguished, and
  - 38.2.2 the Contractor is liable to pay Her Majesty, upon demand, an amount that is equal to the amount of all loss and damage incurred or sustained by Her Majesty in respect of the



Contractor's failure to complete the work.

- 38.3 If the whole or any part of the work that is taken out of the Contractor's hands pursuant to GC38.1 is completed by Her Majesty, the Departmental Representative shall determine the amount, if any, of the holdback or a progress claim that had accrued and was due prior to the date on which the work was taken out of the Contractor's hands and that is not required for the purposes of having the work performed or of compensating Her Majesty for any other loss or damage incurred or sustained by reason of the Contractor's default.
- 38.4 Her Majesty may pay the Contractor the amount determined not to be required pursuant to GC38.3.

**GC39 Effect of Taking the Work Out of the Contractor's Hands**

- 39.1 The taking of the work or any part thereof out of the Contractor's hands pursuant to GC38 does not operate so as to relieve or discharge him from any obligation under the contract or imposed upon him by law except the obligation to complete the performance of that part of the work that was taken out of his hands.
- 39.2 If the work or any part thereof is taken out of the Contractor's hands pursuant to GC38, all plant and material and the interest of the Contractor is all real property, licenses, powers and privileges acquired, used or provided by the Contractor under the contract shall continue to be the property of Her Majesty without compensation to the Contractor.
- 39.3 When the Departmental Representative certifies that any plant, material, or any interest of the Contractor referred to in GC39.2 is no longer required for the purposes of the work, or that it is not in the interest of Her Majesty to retain that plant, material or interest, it shall revert to the Contractor.

**G40 Suspension of Work by Minister**

- 40.1 The Minister may, when in his opinion it is in the public interest to do so, require the Contractor to suspend performance of the work either for a specified or an unspecified period by giving a notice of suspension in writing to the Contractor in accordance with GC11.
- 40.2 When a notice referred to in GC40.1 is received by the Contractor in accordance with GC11, he shall suspend all operations in respect of the work except those that, in the opinion of the Departmental Representative, are necessary for the care and preservation of the work, plant and material.
- 40.3 The Contractor shall not, during a period of suspension, remove any part of the work, plant or material from its site without the consent of the Departmental Representative.
- 40.4 If a period of suspension is 30 days or less, the Contractor shall, upon the expiration of that period, resume the performance of the work and he is entitled to be paid the extra cost, calculated in accordance with GC48 to GC50, of any labour, plant and material necessarily incurred by him as a result of the suspension.





- 40.5 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor agree that the performance of the work will be continued by the Contractor, the Contractor shall resume performance of the work subject to any terms and conditions agreed upon by the Minister and the Contractor.
- 40.6 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor do not agree that performance of the work will be continued by the Contractor or upon the terms and conditions under which the Contractor will continue the work, the notice of suspension shall be deemed to be a notice of termination pursuant to GC41.

#### **GC41 Termination of Contract**

- 41.1 The Minister may terminate the contract at any time by giving a notice of termination in writing to the Contractor in accordance with GC11.
- 41.2 When a notice referred to in GC41.1 is received by the Contractor in accordance with GC11, he shall, subject to any conditions stipulated in the notice, forthwith cease all operations in performance of the contract.
- 41.3 If the contract is terminated pursuant to GC41.1, Her Majesty shall pay the Contractor, subject to GC41.4, an amount equal to
- 41.3.1 the cost to the contractor of all labour, plant and material supplied by him under the contract up to the date of termination in respect of a contract or part thereof for which a Unit Price Arrangement is stipulated in the contract, or
  - 41.3.2 the lesser of
    - 41.3.2.1 an amount, calculated in accordance with the Terms and Payment, that would have been payable to the Contractor had he completed the work, and
    - 41.3.2.2 an amount that is determined to be due to the Contractor pursuant to GC49 in respect of a contract or part thereof for which a Fixed Price Arrangement is stipulated in the contract
- less the aggregate of all amounts that were paid to the Contractor by Her Majesty and all amounts that are due to Her Majesty from the Contractor pursuant to the contract.
- 41.4 If Her Majesty and the Contractor are unable to agree about an amount referred to in GC41.3 that amount shall be determined by the method referred to in GC50.

#### **GC42 Claims Against and Obligations of the Contractor or Subcontractor**

- 42.1 Her Majesty may, in order to discharge lawful obligations of and satisfy claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or the subcontractor but such amount if any, as is paid by Her Majesty, shall not exceed that amount which the Contractor would have been obliged to pay to



such claimant had the provisions of the Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, been applicable to the work. Any such claimant need not comply with the provisions of such legislation setting out the steps by way of notice, registration or otherwise as might have been necessary to preserve or perfect any claim for lien or privilege which claimant might have had;

- 42.2 Her Majesty will not make any payment as described in GC42.1 unless and until that claimant shall have delivered to Her Majesty:
- 42.2.1 a binding and enforceable Judgment or Order of a court of competent jurisdiction setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or
  - 42.2.2 a final and enforceable award of an arbitrator setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or
  - 42.2.3 the consent of the Contractor authorizing a payment.
- For the purposes of determining the entitlement of a claimant pursuant to GC42.2.1 and GC42.2.2, the notice required by GC42.8 shall be deemed to replace the registration or provision of notice after the performance of work as required by any applicable legislation and no claim shall be deemed to have expired, become void or unenforceable by reason of the claimant not commencing any action within the time prescribed by any applicable legislation.
- 42.3 The Contractor shall, by the execution of his contract, be deemed to have consented to submit to binding arbitration at the request of any claimant those questions that need be answered to establish the entitlement of the claimant to payment pursuant to the provisions of GC42.1 and such arbitration shall have as parties to it any subcontractor to whom the claimant supplied material, performed work or rented equipment should such subcontractor wish to be adjoined and the Crown shall not be a party to such arbitration and, subject to any agreement between the Contractor and the claimant to the contrary, the arbitration shall be conducted in accordance with the Provincial or Territorial legislation governing arbitration applicable in the Province or Territory in which the work is located.
- 42.4 A payment made pursuant to GC42.1 is, to the extent of the payment, a discharge of Her Majesty's liability to the Contractor under the contract and may be deducted from any amount payable to the Contractor under the contract.
- 42.5 To the extent that the circumstances of the work being performed for Her Majesty permit, the Contractor shall comply with all laws in force in the Province or Territory where the work is being performed relating to payment period, mandatory holdbacks, and creation and enforcement of mechanics' liens, builders' liens or similar legislation or in the Province of Quebec, the law relating to privileges.
- 42.6 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires Her



Majesty to pay the Contractor.

- 42.7 The Contractor shall, whenever requested to do so by the Departmental Representative, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC42.6.
- 42.8 GC42.1 shall only apply to claims and obligations
- 42.8.1 the notification of which has been received by the Departmental Representative in writing before payment is made to the Contractor pursuant to TP4.10 and within 120 days of the date on which the claimant
- 42.8.1.1 should have been paid in full under the claimant's contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or
- 42.8.1.2 performed the last of the services, work or labour, or furnished the last of the material pursuant to the claimant's contract with the Contractor or subcontractor where the claim is not for money referred to in GC42.8.1.1, and
- 42.8.2 the proceedings to determine the right to payment of which, pursuant to GC42.2. shall have commenced within one year from the date that the notice referred to in GC42.8.1 was received by the Departmental Representative, and
- the notification required by GC42.8.1 shall set forth the amount claimed to be owing and the person who by contract is primarily liable.
- 42.9 Her Majesty may, upon receipt of a notice of claim under GC42.8.1, withhold from any amount that is due and payable to the Contractor pursuant to the contract the full amount of the claim or any portion thereof.
- 42.10 The Departmental Representative shall notify the Contractor in writing of receipt of any claim referred to in GC42.8.1 and of the intention of Her Majesty to withhold funds pursuant to GC42.9 and the Contractor may, at any time thereafter and until payment is made to the claimant, be entitled to post, with Her Majesty, security in a form acceptable to Her Majesty in an amount equal to the value of the claim, the notice of which is received by the Departmental Representative and upon receipt of such security Her Majesty shall release to the Contractor any funds which would be otherwise payable to the Contractor, that were withheld pursuant to the provisions of GC42.9 in respect of the claim of any claimant for whom the security stands.

### **GC43 Security Deposit – Forfeiture or Return**

- 43.1 If
- 43.1.1 the work is taken out of the Contractor's hands pursuant to GC38,
- 43.1.2 the contract is terminated pursuant to GC41, or
- 43.1.3 the Contractor is in breach of or in default under the contract,



Her Majesty may convert the security deposit, if any, to Her own use.

- 43.2 If Her Majesty converts the contract security pursuant to GC43.1, the amount realized shall be deemed to be an amount due from Her Majesty to the Contractor under the contract.
- 43.3 Any balance of an amount referred to in GC43.2 that remains after payment of all losses, damage and claims of Her Majesty and others shall be paid by Her Majesty to the Contractor if, in the opinion of the Departmental Representative, it is not required for the purposes of the contract.

#### **GC44 Departmental Representative's Certificates**

44.1 On the date that

44.1.1 the work has been completed, and

44.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Departmental Representative, the Departmental Representative shall issue a Final Certificate of Completion to the Contractor.

44.2 If the Departmental Representative is satisfied that the work is substantially complete he shall, at any time before he issues a certificate referred to in GC44.1, issue an Interim Certificate of Completion to the Contractor, and

44.2.1 for the purposes of GC44.2 the work will be considered to be substantially complete,

44.2.1.1 when the work under the contract or a substantial part thereof is, in the opinion of the Departmental Representative, ready for use by Her Majesty or is being used for the purpose intended; and

44.2.1.2 when the work remaining to be done under the contract is, in the opinion of the Departmental Representative, capable of completion or correction at accost of not more than

44.2.1.2.1 -3% of the first \$500,000, and

44.2.1.2.2 -2% of the next \$500,000, and

44.2.1.2.3 -1% of the balance

of the value of the contract at the time this cost is calculated.

44.3 For the sole purpose of GC44.2.1.2, where the work or a substantial part thereof is ready for use or is being used for the purposes intended and the remainder of the work or a part thereof cannot be completed by the time specified in A2.1, or as amended pursuant to GC36, for reasons beyond the control of the Contractor or where the Departmental Representative and the Contractor agree not to complete a part of the work within the specified time, the cost of that part of the work



which was either beyond the control of the Contractor to complete or the Departmental Representative and the Contractor have agreed not to complete by the time specified shall be deducted from the value of the contract referred to GC44.2.1.2 and the said cost shall not form part of the cost of the work remaining to be done in determining substantial completion.

44.4 An Interim Certificate of Completion referred to in GC44.2 shall describe the parts of the work not completed to the satisfaction of the Departmental Representative and all things that must be done by the Contractor

44.4.1 before a Final Certificate of Completion referred to in GC44.1 will be issued, and

44.4.2 before the 12-month period referred to in GC32.1.2 shall commence for the said parts and all the said things.

44.5 The Departmental Representative may, in addition to the parts of the work described in an Interim Certificate of Completion referred to in GC44.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the satisfactory completion of the work.

44.6 If the contract or a part thereof is subject to a Unit Price Arrangement, the Departmental Representative shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

44.7 The Contractor shall assist and co-operate with the Departmental Representative in the performance of his duties referred to in GC44.6 and shall be entitled to inspect any record made by the Departmental Representative pursuant to GC44.6.

44.8 After the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, he shall, if GC44.6 applies, issue a Final Certificate of Measurement.

44.9 A Final Certificate of Measurement referred to in GC44.8 shall

44.9.1 contain the aggregate of all measurements of quantities referred to in GC44.6, and

44.9.2 be binding upon and conclusive between Her Majesty and the Contractor as to the quantities referred to therein.

#### **GC45 Return of Security Deposit**

45.1 After an Interim Certificate of Completion referred to in GC44.2 has been issued, Her Majesty shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Departmental Representative, is not required for the purposes of the contract.

45.2 After a Final Certificate of Completion referred to in GC44.1 has been issued, Her Majesty shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.



- 45.3 If the security deposit was paid into the Consolidated Revenue Fund of Canada, Her Majesty shall pay interest thereon to the Contractor at a rate established from time to time pursuant to section 21(2) of the Financial Administration Act.

#### **GC46 Clarification of Terms in GC47 to GC50**

- 46.1 For the purposes of GC47 to GC50,
- 46.1.1 "Unit Price Table" means the table set out in the Articles of Agreement, and
- 46.1.2 "plant" does not include tools customarily provided by a tradesman in practicing his trade.

#### **GC47 Additions or Amendments to Unit Price Table**

- 47.1 Where a Unit Price Arrangement applies to the contract or a part thereof the Departmental Representative and the Contractor may, by an agreement in writing,
- 47.1.1 add classes of labour or material, and units of measurement, prices per unit and estimated quantities to the Unit Price Table if any labour, plant or material that is to be included in the Final Certificate of Measurement referred to in GC44.8 is not included in any class of labour, plant or material set out in the Unit Price Table; or
- 47.1.2 subject to GC47.2 and GC47.3, amend a price set out in the Unit Price Table for any class of labour, plant or material included therein if the Final Certificate of Measurement referred to in GC44.8 shows or is expected to show that the total quantity of that class of labour, plant or material actually performed, used or supplied by the Contractor in performing the work is
- 47.1.2.1 less than 85% of that estimated total quantity, or
- 47.1.2.2 in excess of 115% of that estimated total quantity.
- 47.2 In no event shall the total cost of an item set out in the Unit Price Table that has been amended pursuant to GC47.1.2.1 exceed the amount that would have been payable to the Contractor had the estimated total quantity actually been performed, used or supplied.
- 47.3 An amendment that is made necessary by GC47.1.2.2 shall apply only to the quantities that are in excess of 115%.
- 47.4 If the Departmental Representative and the Contractor do not agree as contemplated in GC47.1, the Departmental Representative shall determine the class and the unit of measurement of the labour, plant or material and, subject to GC47.2 and GC47.3, the price per unit therefore shall be determined in accordance with GC50.

#### **GC48 Determination of Cost – Unit Price Table**



- 48.1 Whenever, for the purposes of the contract, it is necessary to determine the cost of labour, plant or material, it shall be determined by multiplying the quantity of that labour, plant or material expressed in the unit set out in column 3 of the Unit Price Table by the price of that unit set out in column 5 of the Unit Price Table.

#### **GC49 Determination of Cost – Negotiation**

- 49.1 If the method described in GC48 cannot be used because the labour, plant or material is of a kind or class that is not set out in the Unit Price Table, the cost of that labour, plant or material for the purposes of the contract shall be the amount agreed upon from time to time by the Contractor and the Departmental Representative.
- 49.2 For the purposes of GC49.1, the Contractor shall submit to the Departmental Representative any necessary cost information requested by the Departmental Representative in respect of the labour, plant and material referred to in GC49.1

#### **GC50 Determination of Cost – Failing Negotiation**

- 50.1 If the methods described in GC47, GC48 or GC49 fail for any reason to achieve a determination of the cost of labour, plant and material for the purposes referred to therein, that cost shall be equal to the aggregate of
- 50.1.1 all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the labour, plant and material that falls within one of the classes of expenditure described in GC50.2 that are directly attributable to the performance of the contract,
  - 50.1.2 an allowance for profit and all other expenditures or costs, including overhead, general administration cost, financing and interest charges, and every other cost, charge and expenses, but not including those referred to in GC50.1.1 or GC50.1.3 or a class referred to in GC50.2, in an amount that is equal to 10% of the sum of the expenses referred to in GC50.1.1, and
  - 50.1.3 interest on the cost determined under GC50.1.1 and GC50.1.2, which interest shall be calculated in accordance with TP9,

provide that the total cost of an item set out in the Unit Price Table that is subject to the provisions of GC47.1.2.1 does not exceed the amount that would have been payable to the Contractor had the estimated total quantity of the said item actually be performed, used or supplied.

- 50.2 For purposes of GC50.1.1 the classes of expenditure that may be taken into account in determining the cost of labour, plant and material are,
- 50.2.1 payments to subcontractors;
  - 50.2.2 wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living



and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless they are engaged at the work site with the approval of the Departmental Representative,

- 50.2.3 assessments payable under any statutory authority relating to workmen's compensation, unemployment insurance, pension plan or holidays with pay;
- 50.2.4 rent that is paid for plant or an amount equivalent of the said rent if the plant is owned by the Contractor that is necessary for and used in the performance of the work, if the rent of the equivalent amount is reasonable and use of that plant has been approved by the Departmental Representative;
- 50.2.5 payments for maintaining and operating plant necessary for and used in the performance of the work, and payments for effecting such repairs thereto as, in the opinion of the Departmental Representative, are necessary to the proper performance of the contract other than payments for any repairs to the plant arising out of defects existing before its allocation to the work;
- 50.2.6 payments for material that is necessary for and incorporated in the work, or that is necessary for and consumed in the performance of the contract;
- 50.2.7 payments for preparation, delivery, handling, erection, installation, inspection protection and removal of the plant and material necessary for and used in the performance of the contract; and
- 50.2.8 any other payments made by the Contractor with the approval of the Departmental Representative that are necessary for the performance of the contract.

#### **GC51 Records to be kept by Contractor**

##### **51.1 The Contractor shall**

- 51.1.1 maintain full records of his estimated and actual cost of the work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto.
- 51.1.2 make all records and material referred to in GC5.1.1 available to audit and inspection by the Minister and the Deputy Receiver General for Canada or by persons acting on behalf of either of both of them, when requested;
- 51.1.3 allow any of the person referred to in GC51.1.2 to make copies of and to take extracts from any of the records and material referred to in GC51.1.1; and
- 51.1.4 furnish any person referred to in GC51.1.2 with any information he may require from time to time in connection with such records and material.

- 51.2 The records maintained by the Contractor pursuant to GC51.1.1 shall be kept intact by the Contractor until the expiration of two years after the date that a Final Certificate of Completion referred to in GC44.1 was issued or until the expiration of such other period of time as the





Minister may direct.

- 51.3 The Contractor shall cause all subcontractors and all other persons directly or indirectly controlled by or affiliated with the Contractor and all persons directly or indirectly having control of the Contractor to comply with GC51.1 and GC51.2 as if they were the Contractor.

**GC52 Conflict of Interest**

- 52.1 It is a term of this contract that no former public office holder who is not in compliance with the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from this contract.

**GC53 Contractor Status**

- 53.1 The Contractor shall be engaged under the contract as an independent contractor.
- 53.2 The Contractor and any employee of the said Contractor is not engaged by the contract as an employee, servant or agent of Her Majesty.
- 53.3 For the purposes of GC53.1 and GC53.2 the Contractor shall be solely responsible for any and all payments and deductions required to be made by law including those required for Canada or Quebec Pension Plans, Unemployment Insurance, Worker's Compensation or Income Tax.



## **GENERAL CONDITONS**

- IC 1 Proof of Insurance**
- IC 2 Risk Management**
- IC 3 Payment of Deductible**
- IC 4 Insurance Coverage**

## **GENERAL INSUANCE COVERAGES**

- GCI 1 Insured**
- GIC 2 Period of Insurance**
- GIC 3 Proof of Insurance**
- GIC 4 Notification**

## **COMMERCIAL GENERAL LIABILITY**

- CGL 1 Scope of Policy**
- CGL 2 Coverages/Provisions**
- CGL 3 Additional Exposures**
- CGL 4 Insurance Proceeds**
- CGL 5 Deductible**

## **BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS**

- BR 1 Scope of Policy**
- BR 2 Property Insured**
- BR 3 Insurance Proceeds**
- BR 4 Amount of Insurance**
- BR 5 Deductible**
- BR 6 Subrogation**
- BR 7 Exclusion Qualifications**

## **INSURER'S CERTIFICATE OF INSURANCE**



## **General Conditions**

### **IC 1 Proof of Insurance (02/12/03)**

Within thirty (30) days after acceptance of the Contractor's tender, the Contractor shall, unless otherwise directed in writing by the Contracting Officer, deposit with the Contracting Officer an Insurer's Certificate of Insurance in the form displayed in this document and, if requested by the Contracting Officer, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the Insurance Coverage Requirements shown hereunder.

### **IC 2 Risk Management (01/10/94)**

The provisions of the Insurance Coverage Requirements contained hereunder are not intended to cover all of the Contractor's obligations under GC8 of the General Conditions "C" of the contract. Any additional risk management measures or additional insurance coverages the Contractor may deem necessary to fulfill its obligations under GC8 shall be at its own discretion and expense.

### **IC 3 Payment of Deductible (01/10/94)**

The payment of monies up to the deductible amount made in satisfaction of a claim shall be borne by the Contractor.

### **IC 4 Insurance Coverage (02/12/03)**

The Contractor has represented that it has in place and effect the appropriate and usual liability insurance coverage as required by these Insurance Conditions and the Contractor has warranted that it shall obtain, in a timely manner and prior to commencement of the Work, the appropriate and usual property insurance coverage as required by these Insurance Conditions and, further, that it shall maintain all required insurance policies in place and effect as required by these Insurance Conditions.



## INSURANCE COVERAGE REQUIREMENTS

### PART I GENERAL INSURANCE COVERAGES (GIC)

#### **GCI 1 Insured (02/12/03)**

Each insurance policy shall insure the Contractor, and shall include, as an Additional Named Insured, Her Majesty the Queen in right of Canada, represented by the National Research Council Canada.

#### **GIC 2 Period of Insurance (02/12/03)**

Unless otherwise directed in writing by the Contracting Officer or otherwise stipulated elsewhere in these Insurance Conditions, the policies required hereunder shall be in force and be maintained from the date of the contract award until the day of issue of the Departmental Representative's Final Certificate of Completion.

#### **GIC 3 Proof of Insurance (01/10/94)**

Within twenty five (25) days after acceptance of the Contractor's tender, the Insurer shall, unless otherwise directed by the Contractor, deposit with the Contractor an Insurer's Certificate of Insurance in the form displayed in the document and, if requested, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the requirements of these Insurance Coverages.

#### **GIC 4 Notification (01/10/94)**

Each Insurance policy shall contain a provision that (30) days prior written notice shall be given by the Insurer to Her Majesty in the event of any material change in or cancellation of coverage. Any such notice received by the Contractor shall be transmitted forthwith to Her Majesty.

### PART II COMMERCIAL GENERAL LIABILITY

#### **CGL 1 Scope of Policy (01/10/94)**

The policy shall be written on a form similar to that known and referred to in the insurance industry as IBC 2100 – Commercial General Liability policy (Occurrence form) and shall provide for limit of liability of not less than \$2,000,000 inclusive for Bodily Injury and Property Damage for any one occurrence or series of occurrences arising out of one cause. Legal or defence cost incurred in respect of a claim or claims shall not operate to decrease the limit of liability.

#### **CGL 2 Coverages/Provisions (01/10/94)**



The policy shall include but not necessarily be limited to the following coverages/provisions.

- 2.1 Liability arising out of or resulting from the ownership, existence, maintenance or use of premises by the Contractor and operations necessary or incidental to the performance of this contract.
- 2.2 "Broad Form" Property Damage including the loss of use of property.
- 2.3 Removal or weakening of support of any building or land whether such support be natural or otherwise.
- 2.4 Elevator liability (including escalators, hoists and similar devices).
- 2.5 Contractor's Protective Liability
- 2.6 Contractual and Assumed Liabilities un this contact.
- 2.7 Completed Operations Liability – The insurance, including all aspects of this Part II of these Insurance Conditions shall continue for a period of at least one (1) year beyond the date of the Departmental Representative's Final Certificate of Completion for the Completed Operations.
- 2.8 Cross Liability – The Clause shall be written as follows:

Cross Liability – The insurance as is afforded by this policy shall apply in respect to any claim or action brought against any one Insured by any other Insured. The coverage shall apply in the same manner and to the same extent as though a separate policy had been issued to each Insured. The inclusion herein of more than one Insured shall not increase the limit of the Insurer's liability.

- 2.9 Severability of Interests – The Clause shall be written as follows:

Severability of Interests – This policy, subject to the limits of liability stated herein, shall apply separately to each Insured in the same manner and to the same extent as if a separate policy had been issued to each. The inclusion herein of more than one insured shall not increase the limit of the Insurer's liability.

### **CGL 3 Additional Exposures (02/12/03)**

The policy shall either include or be endorsed to include the following exposures of hazards if the Work is subject thereto:

- 3.1 Blasting
- 3.2 Pile driving and calsson work
- 3.3 Underpinning
- 3.4 Risks associated with the activities of the Contractor on an active airport



- 3.5 Radioactive contamination resulting from the use of commercial isotopes
- 3.6 Damage to the portion of an existing building beyond that directly associated with an addition, renovation or installation contract.
- 3.7 Marine risks associated with the contraction of piers, wharves and docks.

**CGL 4 Insurance Proceeds  
(01/10/94)**

Insurance Proceeds from this policy are usually payable directly to a Claimant/Third Party.

**CGL 5 Deductible  
(02/12/03)**

This policy shall be issued with a deductible amount of not more than \$10,000 per occurrence applying to Property Damage claims only.

**PART III  
BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS**

**BR 1 Scope of Policy  
(01/10/94)**

The policy shall be written on an "All Risks" basis granting coverages similar to those provided by the forms known and referred to in the insurance industry as "Builder's Risk Comprehensive Form" or "Installation Floater – All Risks".

**BR 2 Property Insured  
(01/10/94)**

The property insured shall include:

- 2.1 The Work and all property, equipment and materials intended to become part of the finished Work at the site of the project while awaiting, during and after installation, erection or construction including testing.
- 2.2 Expenses incurred in the removal from the construction site of debris of the property insured, including demolition of damaged property, de-icing and dewatering, occasioned by loss, destruction or damage to such property and in respect of which insurance is provided by this policy.

**BR 3 Insurance Proceeds  
(01/10/94)**

- 3.1 Insurance proceeds from this policy are payable in accordance with GC28 of the General Conditions "C" of the contract.
- 3.2 This policy shall provide that the proceeds thereof are payable to Her Majesty or as the Minister may direct.



- 3.3 The Contractor shall do such things and execute such documents as are necessary to effect payment of the proceeds.

**BR 4 Amount of Insurance**  
(01/10/94)

The amount of insurance shall not be less than the sum of the contract value plus the declared value (if any) set forth in the contract documents of all material and equipment supplied by Her Majesty at the site of the project to be incorporated into and form part of the finished Work.

**BR 5 Deductible**  
(02/12/03)

The Policy shall be issued with a deductible amount of not more than \$10,000.

**BR 6 Subrogation**  
(01/10/94)

The following Clause shall be included in the policy:

"All rights of subrogation or transfer of rights are hereby waived against any corporation, firm, individual or other interest, with respect to which, insurance is provided by this policy".

**BR 7 Exclusion Qualifications**  
(01/10/94)

The policy may be subject to the standard exclusions but the following qualifications shall apply:

- 7.1 Faulty materials, workmanship or design may be excluded only to the extent of the cost of making good thereof and shall not apply to loss or damage resulting therefrom.
- 7.2 Loss or damage caused by contamination by radioactive material may be excluded except for loss or damage resulting from commercial isotopes used for industrial measurements, inspection, quality control radiographic or photographic use.
- 7.3 Use and occupancy of the project or any part of section thereof shall be permitted where such use and occupancy is for the purpose for which the project is intended upon completion.



**INSURER'S CERTIFICATE OF INSURANCE**

(TO BE COMPLETED BY INSURER (NOT BOKER) AND DELIVERD TO NATIONAL RESEARCH COUNCIL CANADA WITH 30 DAYS FOLLOWING ACCEPTANCE OF TENDER)

**CONTRACT**

DESCRIPTION OF WORK	CONTRACT NUMBER	AWARD DATE
LOCATION		

**INSURER**

NAME
ADDRESS

**BROKER**

NAME
ADDRESS

**INSURED**

NAME OF CONTRACTOR
ADDRESS

**ADDITIONAL INSURED**

HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY THE NATIONAL RESEARCH COUNCIL CANADA
---

THIS DOCUENT CERTIFIES THAT THE FOLLOWING POLICES OF INSURANCE ARE AT PRESENT IN FORCE COVERING ALL OPERATIONS OF THE INSURE IN CONNECTION WITH THE CONTRACT MADE BETWEEN THE NAMED INSURED AND THE NATIONAL RESEARCH COUNCIL CANADA AND IN ACCORDANCE WITH THE INSURANCE CONDITIONS "E"

POLICY					
TYPE	NUMBER	INCEPTION DATE	EXPIRY DATE	LIMITS OF LIABILITY	DEDUCTIBLE
COMMERCIAL GENERAL LIABILITY					
BUILDERS RISK "AL RISKS"					
INSTALLATION FLOATER "ALL RISKS"					

THE INSURER AGREES TO NOTIFY THE NATIONAL RESEARCH COUNCIL CANADA IN WRITING 30 DAYS PRIOR TO ANY MATERIAL CHANGE IN OR CANCELLATION OF ANY POLICY OR COVERAGE SPECIFICALLY RELATED TO THE CONTRACT

NAME OF INSURER'S OFFICER OR AUTHORIZED EMPLOYEE	SIGNATURE	DATE:
		TELEPHONE NUMBER:

ISSUANCE OF THIS CERTIFIATE SHALL NOT LIMIT OR RESTRICT THE RIGHT OF THE NATIONAL RESEARCH COUNCIL CANADA TO REQUEST AT ANY TIME DUPLICATE COPIES OF SAID INSURANCE POLICIES





**CS1 Obligation to provide Contract Security**

- 1.1 The Contractor shall, at the Contractor's own expense, provide one or more of the forms of contract security prescribed in CS2.
- 1.2 The Contractor shall deliver to the Departmental Representative the contract security referred to in CS1.1 within 14 days after the date that the Contractor receives notice that the Contractor's tender or offer was accepted by Her Majesty.

**CS2 Prescribed Types and Amounts of Contract Security**

- 2.1 The Contractor shall deliver to the Departmental Representative pursuant to CS1
  - 2.1.1 a performance bond and a labour and material payment bond each in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, or
  - 2.1.2 a labour and material payment bond in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, and a security deposit in an amount that is equal to
    - 2.1.2.1 not less than 10% of the contract amount referred to in the Articles of Agreement where that amount does not exceed \$250,000, or
    - 2.1.2.2 \$25,000 plus 5% of the part of the contract amount referred to in the Articles of Agreement that exceeds \$250,000, or
  - 2.1.3 a security deposit in an amount prescribed by CS2.12 plus an additional amount that is equal to 10% of the contract amount referred to in the Articles of Agreement.
- 2.2 A performance bond and a labour and material payment bond referred to in CS2.1 shall be in a form and be issued by a bonding or surety company that is approved by Her Majesty.
- 2.3 The amount of a security deposit referred to in CS2.1.2 shall not exceed \$250,000 regardless of the contract amount referred to in the Articles of Agreement.
- 2.4 A security deposit referred to in CS2.1.2 and CS2.1.3 shall be in the form of
  - 2.4.1 a bill of exchange made payable to the Receiver General of Canada and certified by an approved financial institution or drawn by an approved financial institution on itself, or
  - 2.4.2 bonds of or unconditionally guaranteed as to principal and interest by the Government of Canada.
- 2.5 For the purposes of CS2.4
  - 2.5.1 a bill of exchange is an unconditional order in writing signed by the Contractor and addressed to an approved financial institution, requiring the said institution to pay, on demand, at a fixed or determinable future time a sum certain of money to, or to the order



of, the Receiver General for Canada, and

- 2.5.2 If a bill of exchange is certified by a financial institution other than a chartered bank then it must be accompanied by a letter or stamped certification confirming that the financial institution is in at least one of the categories referred to in CS2.5.3
- 2.5.3 an approved financial institution is
  - 2.5.3.1 any corporation or institution that is a member of the Canadian Payments Association,
  - 2.5.3.2 a corporation that accepts deposits that are insured by the Canada Deposit Insurance Corporation or the Régie de l'assurance-dépôts du Québec to the maximum permitted by law,
  - 2.5.3.3 a credit union as defined in paragraph 137(6)(b) of the *Income Tax Act*,
  - 2.5.3.4 a corporation that accepts deposits from the public, if repayment of the deposit is guaranteed by Her Majesty in right of a province, or
  - 2.5.3.5 The Canada Post Corporation.
- 2.5.4 the bonds referred to in CS2.4.2 shall be
  - 2.5.4.1 made payable to bearer, or
  - 2.5.4.2 accompanied by a duly executed instrument of transfer of the bonds to the Receiver General for Canada in the form prescribed by the Domestic Bonds of Canada Regulations, or
  - 2.5.4.3 registered, as to principal or as to principal and interest in the name of the Receiver General for Canada pursuant to the Domestic Bonds of Canada Regulations, and
  - 2.5.4.4 provided on the basis of their market value current at the date of the contract.



Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

**SECURITY REQUIREMENTS CHECK LIST (SRCL)  
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)**

**PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE**

1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine	National Research Council	2. Branch or Directorate / Direction générale ou Direction	ASPM/SAGI
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3. a) Subcontract Number / Numéro du contrat de sous-traitance	3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant
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4. Brief Description of Work / Brève description du travail

Work under this contract covers the watermain replacement, repairs to storm sewers, parking lot reconstruction and interception and treatment of the sanitary discharge located at the National Research Council, 100 Sussex Drive, Ottawa, Ontario.

5. a) Will the supplier require access to Controlled Goods? / Le fournisseur aura-t-il accès à des marchandises contrôlées?  No / Non  Yes / Oui

5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? / Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?  No / Non  Yes / Oui

6. Indicate the type of access required / Indiquer le type d'accès requis

6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? / Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c) / Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)  No / Non  Yes / Oui

6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. / Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.  No / Non  Yes / Oui

6. c) Is this a commercial courier or delivery requirement with no overnight storage? / S'agit-il d'un contrat de messagerie ou de livraison commerciale sans entreposage de nuit?  No / Non  Yes / Oui

7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès

Canada <input checked="" type="checkbox"/>	NATO / OTAN <input type="checkbox"/>	Foreign / Étranger <input type="checkbox"/>
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7. b) Release restrictions / Restrictions relatives à la diffusion

No release restrictions / Aucune restriction relative à la diffusion <input checked="" type="checkbox"/>	All NATO countries / Tous les pays de l'OTAN <input type="checkbox"/>	No release restrictions / Aucune restriction relative à la diffusion <input type="checkbox"/>
Not releasable / À ne pas diffuser <input type="checkbox"/>		
Restricted to: / Limité à: Specify country(ies): / Préciser le(s) pays: <input type="checkbox"/>	Restricted to: / Limité à: Specify country(ies): / Préciser le(s) pays: <input type="checkbox"/>	Restricted to: / Limité à: Specify country(ies): / Préciser le(s) pays: <input type="checkbox"/>

7. c) Level of information / Niveau d'information

PROTECTED A / PROTÉGÉ A <input type="checkbox"/>	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ <input type="checkbox"/>	PROTECTED A / PROTÉGÉ A <input type="checkbox"/>
PROTECTED B / PROTÉGÉ B <input type="checkbox"/>	NATO RESTRICTED / NATO DIFFUSION RESTREINTE <input type="checkbox"/>	PROTECTED B / PROTÉGÉ B <input type="checkbox"/>
PROTECTED C / PROTÉGÉ C <input type="checkbox"/>	NATO CONFIDENTIAL / NATO CONFIDENTIEL <input type="checkbox"/>	PROTECTED C / PROTÉGÉ C <input type="checkbox"/>
CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>	NATO SECRET / NATO SECRET <input type="checkbox"/>	CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>
SECRET / SECRET <input type="checkbox"/>	COSMIC TOP SECRET / COSMIC TRÈS SECRET <input type="checkbox"/>	SECRET / SECRET <input type="checkbox"/>
TOP SECRET / TRÈS SECRET <input type="checkbox"/>		TOP SECRET / TRÈS SECRET <input type="checkbox"/>
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>



Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

**PART A (continued) / PARTIE A (suite)**

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets?  
 Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS?  No / Non  Yes / Oui  
 If Yes, indicate the level of sensitivity:  
 Dans l'affirmative, indiquer le niveau de sensibilité :

9. Will the supplier require access to extremely sensitive INFOSEC information or assets?  
 Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate?  No / Non  Yes / Oui

Short Title(s) of material / Titre(s) abrégé(s) du matériel :  
 Document Number / Numéro du document :

**PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)**

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

- |   |   |   |  |
|---|---|---|--|
| <input checked="" type="checkbox"/> RELIABILITY STATUS<br>COTE DE FIABILITÉ | <input type="checkbox"/> CONFIDENTIAL<br>CONFIDENTIEL           | <input type="checkbox"/> SECRET<br>SECRET           | <input type="checkbox"/> TOP SECRET<br>TRÈS SECRET               |
| <input type="checkbox"/> TOP SECRET - SIGINT<br>TRÈS SECRET - SIGINT        | <input type="checkbox"/> NATO CONFIDENTIAL<br>NATO CONFIDENTIEL | <input type="checkbox"/> NATO SECRET<br>NATO SECRET | <input type="checkbox"/> COSMIC TOP SECRET<br>COSMIC TRÈS SECRET |
| <input type="checkbox"/> SITE ACCESS<br>ACCÈS AUX EMPLACEMENTS              |   |   |  |

Special comments:  
 Commentaires spéciaux :

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.  
 REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work?  
 Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail?  No / Non  Yes / Oui  
 If Yes, will unscreened personnel be escorted?  
 Dans l'affirmative, le personnel en question sera-t-il escorté?  No / Non  Yes / Oui

**PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)**

**INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS**

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises?  
 Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS?  No / Non  Yes / Oui

11. b) Will the supplier be required to safeguard COMSEC information or assets?  
 Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC?  No / Non  Yes / Oui

**PRODUCTION**

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises?  
 Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ?  No / Non  Yes / Oui

**INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)**

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data?  
 Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS?  No / Non  Yes / Oui

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency?  
 Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale?  No / Non  Yes / Oui



Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

**PART C - (continued) / PARTIE C - (suite)**

For users completing the form manually use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.  
 Les utilisateurs qui remplissent le formulaire manuellement doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form online (via the internet), the summary chart is automatically populated by your responses to previous questions.  
 Dans le cas des utilisateurs qui remplissent le formulaire en ligne (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

**SUMMARY CHART / TABLEAU RÉCAPITULATIF**

Category / Catégorie	PROTECTED / PROTÉGÉ			CLASSIFIED / CLASSIFIÉ			NATO				COMSEC					
	A	B	C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET	NATO RESTRICTED / NATO DIFFUSION RESTREINTE	NATO CONFIDENTIAL / NATO CONFIDENTIEL	NATO SECRET	COSMIC TOP SECRET / COSMIC TRÈS SECRET	PROTECTED / PROTÉGÉ			CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET
											A	B	C			
Information / Assets / Renseignements / Biens																
Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT Media / Support TI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT Link / Lien électronique	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?  
 La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?  No / Non  Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".  
 Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?  
 La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?  No / Non  Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).  
 Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquez qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).



Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

**PART D - AUTHORIZATION / PARTIE D - AUTORISATION**

**13. Organization Project Authority / Chargé de projet de l'organisme**

Name (print) - Nom (en lettres moulées) Doug Sanftenberg	Title - Titre <b>Construction Project Manager</b>	Signature 
Telephone No. - N° de téléphone 613-993-9628	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel Doug.Sanftenberg@nrc-cnrc.gc.ca
		Date June, 2016

**14. Organization Security Authority / Responsable de la sécurité de l'organisme**

Name (print) - Nom (en lettres moulées) Charlotte Carrier	Title - Titre <b>Controlled Goods and Contracts Security Coordinator</b>	Signature 
Telephone No. - N° de téléphone (613) 993-8956	Facsimile No. - N° de télécopieur (613) 990-0946	E-mail address - Adresse courriel Charlotte.Carrier@nrc-cnrc.gc.ca
		Date 15 Jun 2016

15. Are there additional instructions (e.g. Security Guide, Security Classification Guide) attached?  
Des instructions supplémentaires (p. ex. Guide de sécurité, Guide de classification de la sécurité) sont-elles jointes?

No / Non  Yes / Oui

**16. Procurement Officer / Agent d'approvisionnement**

Name (print) - Nom (en lettres moulées) <b>Alain Leves</b>	Title - Titre <b>Senior Contracting Officer</b>	Signature 
Telephone No. - N° de téléphone (613) 991-9980	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel alain.leves@nrc-cnrc.gc.ca
		Date 6-7-2016

**17. Contracting Security Authority / Autorité contractante en matière de sécurité**

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel
		Date