Town of Stratford

Community Campus Site Servicing

Issued for Approval and Tender

March 2023
Contract 222617.00

Town of Stratford

Community Campus Site Servicing

Issued for Approval & Tender		March 17, 2023	TSL
Issue or Revision	***Reviewed By:***	***Date***	***Issued By:***

CBCL

PROFESSIONAL ENGINEER
THE ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF PRINCE EDWARD ISLAND
Tim LeLacheur
1453
Mar 17, 2023
DATE
PROVINCE OF PRINCE EDWARD ISLAND

Issued for Approval and Tender
CBCL No: 222617.00

Division 33 - Utilities

Appendices

1. GENERAL

1. The project is located in Stratford, PEI, between Bunbury Road and Hollis Ave. The work generally includes construction of new streets and asphalt trails including environmental protection measures, sanitary sewer, manholes, forcemain, lift station, watermain, valves, fittings, hydrants, storm sewer, swales, sediment ponds, lot services, underground electrical, trail lighting, site grading, and reinstatement.

2. LIST OF DRAWINGS

DRAWING NO.	TITLE
0	COVER
CIVIL	
C01	OVERALL SITE PLAN
C02	OVERALL EROSION & SEDIMENT CONTROL PLAN 1
C03	OVERALL EROSION & SEDIMENT CONTROL PLAN 2
C04	OVERALL EROSION & SEDIMENT CONTROL PLAN 3
C05	PLAN & PROFILE SEDIMENT POND 1
C06	PLAN & PROFILE SEDIMENT POND 2
C07	PLAN, PROFILE & SECTION SEDIMENT POND 3
C08	PLAN, PROFILE & SECTIONS SEDIMENT CONTAINMENT SWALE
C09	PLAN & SECTIONS SEDIMENT POND 1 & 2
C10	PLAN & PROFILE SOUTH OUTLET
C11	PLAN & PROFILE STREET A STA 0+220 TO 0+300
C12	PLAN & PROFILE STREET A STA 0+300 TO 0+620
C13	PLAN & PROFILE STREET A STA 0+620 TO 0+940
C14	PLAN & PROFILE STREET A STA 0+960 TO 1+280
C15	PLAN & PROFILE STREET A STA 1+260 TO 1+580

2. LIST OF DRAWINGS
(Cont'd)

C16 PLAN & PROFILE STREET A
STA 1+580 TO 1+730

C17 PLAN & PROFILE STREET B
STA 1+190 TO 2+240

C18 PLAN & PROFILE LIFT STATION SEWER
STA 3+000 TO 3+240

C19 PLAN & PROFILE HOLLIS AVE
STA 4+780 TO 4+960

C20 SECTIONS STA 0+020 TO 0+560

C21 SECTIONS STA 0+580 TO 1+120

C22 SECTIONS STA 1+140 TO 1+680

C23 SECTIONS STA 1+700 TO 1+720
& 2+020 TO 2+240

C25 LIFT STATION PLAN & SECTIONS

C24 PAVEMENT MARKING & SIGNAGE PLAN

C26 DETAILS No. 1

C27 DETAILS No. 2

C28 DETAILS No. 3

C29 DETAILS No. 4

ELECTRICAL

E01 DISTRIBUTION & LIGHTING SYSTEM LAYOUT

E02 DISTRIBUTION & LIGHTING SCHEMATIC

E03 DISTRIBUTION DETAILS

E04 LIGHTING DETAILS

E05 LIFT STATION PLAN & SECTIONS

E06 LIFT STATION SINGLE LINE DIAGRAM & DETAILS

END OF SECTION

1. A complete Tender is comprised of the following:

   a) The Tender Form in its entirety, with all pages and spaces for entry of information by Tenderers filled in as instructed.

   b) Addenda received by the Tenderer during the tendering period.

   c) Tender Security (refer to clause 12 herein).

2. The tender shall be submitted in a sealed envelope marked as follows:

   TENDER FOR

   Town of Stratford
   Community Campus Site Servicing
   Contract No. 222617.00

   and must be delivered to the following address **up until 2:00:00 p.m.**, local time, on **April 5, 2023** hereinafter referred to as the Tender Closing.

   Town of Stratford
   235 Shakespeare Drive
   Stratford, PEI C1B 2V8

3. Tender opening will occur immediately following tender closing. Tender opening will be public.

4. Before tendering, Tenderers should have examined the site of the work and shall have satisfied themselves as to the working conditions, including labour conditions and labour rules, the nature and kind of work to be done, any special risks associated therewith and all other matters which may be necessary in order to form a proper conception under which the work will be required to be performed. Tenderers shall not be entitled to claim at any time after execution of the Contract that there was any misunderstanding in regard to all such conditions.

5. When forming their estimates and preparing their tenders, Tenderers shall take full cognizance of the content of all the Contract Documents listed in Section 00 41 43.

6. Any questions, ambiguities, inconsistencies, or uncertainties in the Contract Documents which may become apparent to Tenderers when tendering shall be advised IN WRITING to Rachel McIntosh:rmcintosh@cbcl.ca not less than three (3) working days before Tender closing. Tenderers will be advised simultaneously of any decisions on such matters as necessary by means of addenda (which will be serially numbered).

7. The Tenderer shall fill in the Completion Time and is notified that the completion date based on this may be taken into account in considering the tenders.

8. All tenders shall be valid for acceptance for thirty (30) calendar days from the Closing Date.

9. The Agreement is included in the Contract Documents at the time of tendering only for information and shall not be completed at the time of tendering.

10. The appending of any qualifying clauses to the tender or failure to comply with these instructions and with all other relevant provisions contained in the documents in the completing of any tender renders such tender liable to disqualification.

11. Contract Price to exclude HST. Harmonized sales tax shall be indicated as a separate amount and included in the Total Amount Payable.

12. Each tender shall be accompanied by Tender Security in the amount of ten percent (10%) of the Total Amount Payable in evidence of the bona fide nature of the tender. This Tender Security shall be in favour of the Owner and shall be in the form of a Certified Cheque, irrevocable Letter of Credit or a Bid Bond which shall guarantee to the Owner that in the event of the successful Tenderer declining to enter into a formal agreement with the Owner as called for in the Contract Documents, or declining or neglecting to provide the Insurance or Contract Security required by the Contract Documents, then the Owner will be reimbursed the additional cost of accepting another tender or Tender Security amount, whichever is the lesser.
.1 The bonds shall be issued by a company whose guarantee bonds are acceptable to the Government of Canada. Use latest edition of CCDC Form 220.

13. The "Town of Stratford", "Stratford Utility Corporation", "Province of Prince Edward Island", and "CBCL Limited" are to be added to all insurance policies as an "Additional Insured".

14. The Tender Security of the unsuccessful Tenderers will be returned to them after the Owner enters into a formal agreement with the successful Tenderer or the expiration of validity of their tenders, whichever is the sooner.

15. On the written acceptance by the Owner of a tender, that tender becomes the Contract and the Tenderer who has submitted it becomes the Contractor. The Contractor will be required to enter into a formal agreement with the Owner following receipt of a written notice of acceptance from the Owner. The written notice of acceptance forms a Contract Agreement until the formal "Agreement" is executed.

16. Within seven (7) days of written acceptance of a tender that tender shall provide Contract Security in the amount and form as specified in GC 11.2 and as supplemented in Section 00 73 00, and Insurance as specified in GC 11.1.

17. Complete the Tender Form in ink and have corrections initialled by the individual signing the tender.

18. Where manufactured articles are described or specified in the Contract Documents by name, catalogue number of a manufacturer or supplier, Tenderers shall tender on the basis of using only such articles. Procedure concerning substitution of a specified article with another shall be in accordance with equivalents and alternates in Section 01 00 00.

19. The Owner will not defray any expenses whatsoever incurred by Tenderers in the preparation and submission of their tenders. The Owner reserves the right to waive any formality or technicality in any tender.

20. The Owner reserves the right to accept or to reject any or all tenders received, or to select a tender which is deemed by the Owner to be in its best interests.

21. Tenders, which in the opinion of the Owner are considered to be informal or unbalanced, may be rejected.

22. The project budget is sensitive and following the close of tenders and prior to award, it may be necessary to adjust the scope to match available dollars.

23. Tenders may be amended or withdrawn by letter, or facsimile, prior to Tender Closing. Amendments shall not disclose either original or revised total price.
    1. Head amendment or withdrawal as follows: "[Amendment]/[Withdrawal] of Tender for the "Town of Stratford Community Campus Site Servicing, Contract 222617.00". Signed and seal as required for tender and submit at address given for receipt of tenders. All submissions must be received prior to Tender Closing

24. A geotechnical investigation has been carried out at the site. Information from the Geotechnical Investigation Report, Community Campus Site Surveying, Stratford PE Prepared by CBCL Limited Dated July 18, 2022 is attached as appendix A. Any interpretations shall be at the Tenderers own risk and neither the Consultant nor the Owner shall be held responsible for the interpretation of this information.

END OF SECTION

1. SALUTATION:

.1 To: Town of Stratford
234 Shakespeare Drive
Stratford, PE C1B 2B8

.2 For: Community Campus – Site Servicing
Contract No. 222617.00

.3 From: _____

2. TENDERER DECLARES:

.1 That this tender was made without collusion or fraud.

.2 That the proposed work was carefully examined.

.3 To have personal knowledge of the location of the proposed Work and is informed as to the actual conditions and requirements, including labour conditions and labour rules and shall not claim at any time after execution of the Agreement that there was any misunderstanding in regard to such conditions and requirements.

.4 That Contract Documents and Addenda No. ___ to ___ inclusive were carefully examined.

.5 That all the above were taken into consideration in preparation of this Tender.

3. TENDERER AGREES:

.1 To enter into a contract to supply all labour, material and equipment and to do all work necessary to construct the Work as described and specified herein for the unit prices stated in Subsection 4 hereunder, Schedule of Quantities and Unit Prices.

.2 That the estimated Contract Price shall be the sum of the products of the tendered unit prices multiplied by the estimated quantities in Subsection 4 hereunder.

.3 That this Tender is valid for acceptance for thirty (30) days from the time of Tender Closing.

.4 That measurement and payment for items listed in Subsection 4 hereunder shall be in accordance with corresponding items in Section 01 22 00 Measurement and Payment.

.5 Upon request to provide evidence of ability and experience within

7 days of request, including experience in similar work, work currently under contract, senior supervisory staff available for the project, equipment available for use on the Work, and financial resources.

.6 To execute in triplicate the Agreement and forward same together with the specified contract security and insurance documents to the Owner within fourteen (14) days of written notice of award.

.7 That failure to enter into a formal contract and give specified insurance documents and contract security within time required will constitute grounds for forfeiture of certified cheque or enforcement of bid bond.

.8 That if certified cheque is forfeited, Owner will retain difference in money between amount of Tender and amount for which Owner legally contracts with another party to perform the Work and will refund balance, if any, to Tenderer.

.9 Declares to have carefully examined the documents and Addenda No. _____to _____ referred to in the first paragraph of this Tender Form, and the Tenderer hereby accepts and agrees to the same as forming a part of the Contract.

.10 Understands that in the event that the tendered Contract Price is not within the project budget, the Owner has the right to negotiate the Contract with the low bidder or reject all tenders received.

.11 Agrees that the Warranty Period defined in the Contract Documents shall be for a period of one (1) year from the date of Substantial Performance of the Work.

.12 Understands that Substantial Performance of the Work will be established in accordance with General Conditions of the Contract and applicable lien legislation.

.13 Understands that after the issuance of the certificate of Substantial Performance of the Work by the Consultant, provided that the Contractor has relieved the Owner from any and all claims, demands and lien claims for and in respect of the Contract, and has completed all outstanding items and corrected all deficiencies, the Contractor shall submit an application for Final Payment and the Consultant will thereafter prepare the Final Certificate for payment in accordance with the General Conditions of the Contract and applicable lien legislation

.14 Understands that the payment of holdback will be in accordance with the General Conditions of the Contract and subject to the provisions of the lien legislation applicable to the Place of Work.

.15 Understands the occupational Health and Safety Legislation and any Workers or Workplace compensation legislation applicable to the Place of the Work and declares that they are in good standing and have all necessary certification as required by such legislation.

.16 Agrees that time shall be construed as being of the essence of the Contract.

.17 That the Contract Documents include:
- .1 Description of work and list of drawings
- .2 Instruction to Tenderers
- .3 Tender Form – Unit Price
- .4 Form of Agreement
- .5 General Conditions of the Civil Work Contract
- .6 Supplementary General Conditions
- .7 Drawings

Dwg. No.	Title
-	Cover
C01	OVERALL SITE PLAN
C02	OVERALL EROSION & SEDIMENT CONTROL PLAN 1
C03	OVERALL EROSION & SEDIMENT CONTROL PLAN 2
C04	OVERALL EROSION & SEDIMENT CONTROL PLAN 3
C05	PLAN & PROFILE SEDIMENT POND 1
C06	PLAN & PROFILE SEDIMENT POND 2
C07	PLAN, PROFILE & SECTION SEDIMENT POND 3
C08	PLAN, PROFILE & SECTIONS SEDIMENT CONTAINMENT SWALE
C09	PLAN & SECTIONS SEDIMENT POND 1 & 2
C10	PLAN & PROFILE SOUTH OUTLET
C11	PLAN & PROFILE STREET A STA 0+220 TO 0+300
C12	PLAN & PROFILE STREET A STA 0+300 TO 0+620
C13	PLAN & PROFILE STREET A STA 0+620 TO 0+940
C14	PLAN & PROFILE STREET A STA 0+960 TO 1+280
C15	PLAN & PROFILE STREET A STA 1+260 TO 1+580

C16 PLAN & PROFILE STREET A
STA 1+580 TO 1+730

C17 PLAN & PROFILE STREET B
STA 1+190 TO 2+240

C18 PLAN & PROFILE LIFT STATION SEWER
STA 3+000 TO 3+240

C19 PLAN & PROFILE HOLLIS AVE
STA 4+780 TO 4+960

C20 SECTIONS STA 0+020 TO 0+560

C21 SECTIONS STA 0+580 TO 1+120

C22 SECTIONS STA 1+140 TO 1+680

C23 SECTIONS STA 1+700 TO 1+720
& 2+020 TO 2+240

C25 LIFT STATION PLAN & SECTIONS

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ELECTRICAL

E01 DISTRIBUTION & LIGHTING SYSTEM LAYOUT

E02 DISTRIBUTION & LIGHTING SCHEMATIC

E03 DISTRIBUTION DETAILS

E04 LIGHTING DETAILS

E05 LIFT STATION PLAN & SECTIONS

E06 LIFT STATION SINGLE LINE DIAGRAM & DETAILS

.8 Addenda as issued and as confirmed in subsection 2.4 of this section.

4A. Package A - SCHEDULE OF QUANTITIES AND UNIT PRICES

Item	Description	Unit	Qty.	Unit Price	Amount
1.	Removals	L.S	1	_____	_____
2.	Locate and Accommodate Existing Systems	L.S.	1	_____	_____
3.	Environmental Protection				
	.01 Silt Fence	m	1700	_____	_____
	.02 Straw Bale Check Dam	No.	30	_____	_____
	.03 Rip Rap Check Dam	No.	175	_____	_____
	.04 Pond 2	L.S.	1	_____	_____
	.05 Pond 3	L.S.	1	_____	_____
	.06 Sediment Containment Swale	L.S.	1	_____	_____
	.07 Major Drainage Swale	m	400	_____	_____
	.08 Erosion Control Mat (Provisional)	m^2	5000	_____	_____
	.09 200mm Silt Sock	m	1200	_____	_____
	.10 300mm Silt Sock	1	100		
4.	Clearing and Grubbing				
	.01 Road Construction & Site Servicing	L.S.	1	_____	_____
5.	Sanitary Sewer Main				
	.01 200mm PVC DR35	m	1150	_____	_____
6.	Sanitary Manhole				
	.01 1050mm Dia.	No.	16	_____	_____
	.02 1200mm Dia.	No.	3	_____	_____
7.	Sanitary Sewer Services				
	.01 100mm PVC DR28	m	60	_____	_____
	.02 150mm PVC DR28	m	30	_____	_____
8.	Closed Circuit Television Inspection	L.S.	1	_____	_____
9.	Sanitary Forcemain				
	.01 200mm PVC	m	990	_____	_____
	.03 Air Release Valve & Chamber	L.S.	1	_____	_____
10.	Lift Station				
	.01 Lift Station	L.S.	1	_____	_____
	.02 Access Driveway	L.S.	1	_____	_____

Item Description	Unit	Qty.	Unit Price	Amount
11. Watermain				
.01 200mm PVC	m	225	_____	_____
.02 250mm PVC	m	620	_____	_____
.03 300mm PVC	m	880	_____	_____
12. Water Valves				
.01 200mm Gate Valve	No.	3	_____	_____
.02 250mm Gate Valve	No.	3	_____	_____
.03 300mm Gate Valve	No.	6	_____	_____
13. Fire Hydrants & Valve	No.	18	_____	_____
14. Water Services				
.01 25mm Type K Copper	No.	5	_____	_____
.02 100mm PVC Domestic	No.	1	_____	_____
.03 150mm PVC Sprinkler	No.	1	_____	_____
15. Storm Main				
.01 300mm HDPE	m	180	_____	_____
.02 375mm HDPE	m	30	_____	_____
.03 450mm HDPE	m	525	_____	_____
.04 525mm HDPE	m	65	_____	_____
.05 600mm HDPE	m	220	_____	_____
.06 750mm HDPE	m	60	_____	_____
.07 1050mm HDPE	m	25	_____	_____
.08 1200mm HDPE	m	25	_____	_____
16. Catch Basins & Tees				
.01 750mm dia.	No.	7	_____	_____
.02 1050mm dia.	No.	12	_____	_____
.03 1200mm dia.	No.	2	_____	_____
.04 1500mm dia.	No.	3	_____	_____
.05 1800mm dia.	No.		_____	_____
.06 2100mm dia.	No.	4	_____	_____
.07 450mm Catch Tee	No.	1	_____	_____
17. Road Construction				
.01 Roadbed/Ditches/Shoulders (Campus)	m	1340	_____	_____
.02 Roadbed/Ditches/Shoulders (Business Park)	m	380	_____	_____
.03 Temporary Access Road	L.S.	1	_____	_____

Item Description	Unit	Qty.	Unit Price	Amount
.04 Temporary Cul-De-Sac	L.S.	1	_____	_____
.05 Structural Fill (Provisional)	C.M.	500	_____	_____
18. Asphalt Paving				
.01 Asphalt Base (Campus Cross Section)	m	1340	_____	_____
.02 Asphalt Seal (Campus Cross Section)	m	1340	_____	_____
.03 Asphalt Base (Business Park Cross Section)	m	380	_____	_____
.04 Asphalt Seal (Business Park Cross Section)	m	380	_____	_____
19. Traffic Control Devices				
.01 Traffic Signage	No.	14	_____	_____
.02 Pavement Markings	L.S.	1	_____	_____
20. Active Transportation Trail	m		_____	_____
21. Reinstatement				
.01 Road Construction	L.S.	1	_____	_____
22. Electrical & Communications				
.01 Electrical & communications systems	L.S.	1	_____	_____
.02 Supply & Install Light Bases	No.	27	_____	_____
.03 Supply & Install Street Lights	No.	27	_____	_____
.04 Maritime Electric Cash Allowance	L.S.	1	$250,000	$250,000
23. Rigid Insulation (Provisional)	S.M.	100	_____	_____
24. General Contingency Allowance		-		
	Net Amount		$_____	

4B. Package B (Bunbury Rd Connection)- SCHEDULE OF QUANTITIES AND UNIT PRICES

Item	Description	Unit	Qty.	Unit Price	Amount
1.	Removals		-		
2.	Locate and Accommodate Existing Systems		-		
3.	Environmental Protection				
	.01 Straw Bale Check Dam	No.	5	_____	_____
	.02 Rip Rap Check Dam	No.	2	_____	_____
4.	Clearing & Grubbing		-		
5.	Sanitary Sewer Main		-		
6.	Sanitary Manhole		-		
7.	Sanitary Sewer Services		-		
8.	Closed Circuit Television Inspection		-		
9.	Sanitary Forcemain		-		
10.	Submersible Pumping Station		-		
11.	Watermain				
	.02 250mm PVC	m	220	_____	_____
12.	Water Valves				
	.02 250mm Gate Valve	No.	2	_____	_____
13.	Fire Hydrants & Valve	No.	2	_____	_____
14.	Water Services				
	.01 19mm Type K Copper	No.	1	_____	_____
15.	Storm Main				
	.03 375mm HDPE	m	40	_____	_____
	.05 600mm HDPE	m	80	_____	_____
16.	Catch Basins & Tees				
	.01 750mm dia.	No.	1	_____	_____
	.02 1050mm dia.	No.	1	_____	_____
	.03 1200mm dia.	No.	2	_____	_____
	.07 1500mm dia.	No.	2	_____	_____
17.	Road Construction				
	.01 Roadbed/Ditches/Shoulders (Campus)	m^2	2750	_____	_____
	.02 Structural Fill (Provisional)	C.M.	100	_____	_____
18.	Asphalt Paving				

Item Description	Unit	Qty.	Unit Price	Amount
.01 Asphalt Base	m^2	2100	_____	_____
.02 Asphalt Seal	m^2	2100	_____	_____
19. Traffic Control Devices				
.01 Traffic Signage	No.	3	_____	_____
20. Active Transportation Trail	m	220	_____	_____
21. Reinstatement		-		
22. Electrical		-		
23. Rigid Insulation (Provisional)	S.M.	10	_____	_____
23. General Contingency Allowance	L.S.	1	$200,000	$200,000
	Net Amount		$_____	

4C. Package C (Future Sports Fields)- SCHEDULE OF QUANTITIES AND UNIT PRICES

Item	Description	Unit	Qty.	Unit Price	Amount
1.	Removals		-		
2.	Locate and Accommodate Existing Systems		-		
3.	Environmental Protection				
	.01 Silt Fence (Provisional)	m	30	_____	_____
	.02 Straw Bale Check Dam	No.	5	_____	_____
	.03 Rip Rap Check Dam	No.	15	_____	_____
	.04 Pond 1	L.S.	1	_____	_____
	.05 Major Drainage Swale	m	250	_____	_____
	.06 Erosion Control Mat (Provisional)	m^2	1000	_____	_____
	.07 200mm Silt Sock	m	450	_____	_____
	.08 300mm Silt Sock	m	30		
4.	Clearing and Grubbing				
	.01 Sports Fields	L.S.	1	_____	_____
5.	Sanitary Sewer Main		-		
6.	Sanitary Manhole		-		
7.	Sanitary Sewer Services		-		
8.	Closed Circuit Television Inspection		-		
9.	Sanitary Forcemain		-		
10.	Submersible Pumping Station		-		
11.	Watermain		-		
12.	Water Valves		-		
13.	Fire Hydrants & Valve		-		
14.	Water Services		-		
15.	Storm Main				
	.02 375mm HDPE	m	10	_____	_____
16.	Catch Basins & Tees		-		
17.	Road Construction		-		
18.	Asphalt Paving		-		
19.	Traffic Control Devices		-		
20.	Active Transportation Trail		-		
21.	Reinstatement				

Item Description	Unit	Qty.	Unit Price	Amount
.01 Soccer Field Area	m^2	57,000	_____	_____
.02 Cricket Field Area	m^2	31,000	_____	_____
.03 Baseball Field Area	m^2	51,000	_____	_____
22. Electrical		-		
23. Rigid Insulation (Provisional)		-		
24. General Contingency Allowance		-		
	Net Amount		$_____	

SUBTOTAL (Package A+B+C) **$_____**

Add HST (15% of the Estimated Contract Price) $_____

TOTAL TENDER AMOUNT **$_____**

TENDERER'S HST REGISTRATION NO. _____

5. SCHEDULE and COMPLETION TIME

1. The Tenderer agrees to construct the temporary access road prior to June 1st, 2023.
2. The Tenderer agrees that work within the limits of Phase 2 shall not begin prior to September 15th, 2023, unless directed by the Owner's Representative.
3. The Tenderer agrees that Phase 1 shall be Substantially Performed prior to December 1st, 2023 except for asphalt seal and pumping station commissioning.
4. The Tenderer agrees that asphalt seal shall be placed in 2024.
5. Tenderer agrees to complete Substantial Performance of the Work within _____ weeks from written notification of Award.

6. ALTERNATIVE PRICE

6. Alternative Prices requested in the Tender documents and expressed as a credit or an extra to the Contract Price shall be used in calculation of the Total Amount Payable consistent with their acceptance or rejection by the Owner.

The Alternative Price required is as follows:

Item Description	Alternative Price ($), excl. HST	
	Credit	Extra
1.Source select borrow at site location in lieu of using own borrow source.		
2. Revise sand bedding to stone bedding including geotextile – per metre price.		

.2 The low tender price shall be determined on the basis of lowest Contract Price in accordance with the Contract Documents on which the project is to be actually constructed, including those alternatives for which prices have been invited and which are to be incorporated into the work.

7. SIGNATURE *

DATED THIS _____ DAY OF_____ , 202___.

[Seal]

_____
Name of Firm Tendering

_____ _____
Witness Signature of Signing Officer

_____
Name and Title (Printed)

_____ _____
Witness Signature of Signing Officer

_____
Name and Title (Printed)

_____
Company Address

_____
Telephone No.

_____
Fax No.

*NOTE: Tenders submitted by or on behalf of any Corporation must be signed and sealed in the name of such Corporation by a duly authorized officer or agent.

END

General

Agreement: CCDC18-2001, Civil Works Contract, as amended below form the basis of this Agreement between the Owner and Contractor, including definitions of specific words and terms.

This Agreement made on the 13th day of July in the year 2022.

BY AND BETWEEN

Town of Stratford

hereinafter called the "Owner"

and

hereinafter called the "Contractor"

The Owner and the Contractor agree as follows:

ARTICLE A1 - THE WORK

The Contractor shall:

.1 Perform the Work required by the Contract Documents for

Community Campus Site Servicing Contract No.222617.00

located at Stratford, PEI

for which the Agreement has been signed by the parties, and for which CBCL Limited

(Insert above the name of the Consultant)

is acting as and is hereinafter called the "Consultant"

and

.2 do and fulfill everything indicated by this Agreement, and

.3 commence the Work by the th day of _____ in the year 202 and attain Substantial Performance as certified by the Consultant by the _____ day of _____ in the year 202 .

ARTICLE A2 – AGREEMENTS AND AMENDMENTS

The Contract supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the work, including the bidding documents that are not expressly listed in Article 3 of the Agreement.

ARTICLE A3 - CONTRACT DOCUMENTS

The following are the Contract Documents referred to in Article A1 of the Agreement – THE WORK:

.1 Tender Form
.2 Supplementary Tender Information
.3 Agreement Between Owner and Contractor
.4 Definitions
.5 The General Conditions of the Contract
.6 Supplementary General Conditions
.7 Schedule of Prices
.8 Specifications (as included in Specification Section 00 01 11, List of Contents)
.9 Drawings (as listed in Specification Section 00 21 10, Description of Work and List of Drawings)
.10 Addenda ___ through ___

ARTICLE A4 - CONTRACT PRICE

.1 *Unit Prices* form the basis for payment of the *Contract Price*. Quantities in the *Schedule of Quantities and Unit Prices* are estimated. The estimated *Contract Price*, which is the total extended amount indicated in the *Schedule of Quantities and Unit Prices*, is:

_____

_____/100 dollars _____

.2 All amounts are in Canadian funds. Unit Prices **exclude** HST and Contract Price **includes** HST.

.3 These amounts shall be subject to adjustments as provided in the *Contract Documents*.

.4 The *Contract Price* will be the sum of the products of the actual final quantities that are incorporated in, or made necessary by the *Work*, as confirmed by count and measurement, multiplied by the appropriate *Unit Prices* from the Tender Form together with any adjustments that are made in accordance with the provisions of the *Contract Documents* plus the amount of GST.

ARTICLE A5 - PAYMENT

.1 Subject to the provisions of the *Contract Documents*, the *Owner* shall make monthly payments on account to the *Contractor* for the work performed, as certified by the *Consultant*, subject to a fifteen percent (15%) holdback, the *Owner* shall in Canadian funds:

.1 make progress payments to the *Contractor* on account of the *Contract Price* when due in the amount certified by the *Consultant* together with such *Value Added Taxes* as may be applicable to such payment, and

.2 The Owner shall release to the Contractor 75% of the holdback within two weeks of the date on which all of the following requirements have been met:

(a) 60 days have elapsed from the Date of Substantial Performance of the Works as certified by the Consultant.

(b) 7 days have elapsed from the date on which the Consultant issued the Certificate of Substantial Performance of the Works.

(c) The Contractor has signed the Final Measure.

(d) The Contractor has provided the Consultant with the following documents.

(1) a statutory declaration to the effect that all expenses incurred in carrying out the Contract have been paid and releasing the Authority from any and all further claims relating to the Contract.

(2) a certificate from a Barrister stating that there are no Mechanics' Liens filed relating to the contract works.

(3) a clearance certificate from the Worker's Compensation Board, and

.3 upon the issuance of the final certificate for payment, pay to the *Contractor* the unpaid balance of the *Contract Price* when due together with such *Value Added Taxes* as may be applicable to such payment.

.2 In the event of loss or damage occurring where payment becomes due under the property and boiler insurance policies, payments shall be made to the *Contractor* in accordance with the provisions of GC11.1 – INSURANCE.

.3 Interest:

.1 Should either party fail to make payments as they become due under the terms of the Contract or in an award by arbitration or court, interest at two percent (2%) per annum above the prime rate on such unpaid amounts shall also become due and payable until payment. Such interest shall be compounded on a monthly basis. The bank rate shall be the rate established by the Bank of Canada as the minimum rate at which the Bank of Canada makes short term advances to the chartered banks.

.2 Interest shall apply at the rate and in the manner prescribed by paragraph 5.3.1 of this Article on the settlement amount of any claim in dispute that is resolved either pursuant to Part 8 of the General Conditions – DISPUTE RESOLUTION or otherwise,

from the date the amount would have been due and payable under the *Contract*, had it not been in dispute, until it is paid.

ARTICLE A6 - RECEIPT OF AND ADDRESSES FOR NOTICES

.1 Notices in writing between the parties or between them and the *Consultant* shall be considered to have been received by the addressee on the date of delivery if delivered to the individual, or to a member of the firm, or to an officer of the corporation for whom they are intended by hand or by registered post; or if sent by regular post, to have been delivered within 5 *Working Days* of the date of mailing when addressed as follows:

.1 The Owner at 234 Shakespeare Dr,

Stratford, PE C1B 2V8

(Address of Owner)

.2 The Contractor at _____

_____

(Address of Contractor)

.3 The Consultant at 135 St. Peters Road, P.O. Box 1659

Charlottetown, PE C1A 7N4

(Address of Consultant)

ARTICLE A7 - QUANTITIES AND MEASUREMENT

.1 The quantities shown in Section 00 41 43 Tender Form - Schedule of Quantities and Unit Prices are estimated.

.2 Measurement for the actual quantities used to determine payments and Contract Price shall be in accordance with Section 01 29 00 – Project Particulars and Measurement.

ARTICLE A8 - SUCCESSION

The aforesaid *Contract Documents* are to be read into and form part of the Agreement and the whole shall constitute the *Contract* between the parties and subject to law and the provisions of the Contract Documents shall enure to the benefit of and be binding upon the parties hereto, their respective heirs, legal representatives, successors and assigns.

ARTICLE A9 - RIGHTS AND REMEDIES

No action or failure to act by the *Owner*, *Consultant*, or *Contractor* shall constitute a waiver of any right or duty afforded any of them under the Contract, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be

specifically agreed in writing.

ARTICLE A10 - TIME

Time shall be construed as being of the essence of the *Contract*. The *Works* will be completed by the date indicated in Article A1 herein and shall be referred to as the *Date of Completion*.

ARTICLE A11– LIQUIDATED DAMAGES

Should the *Contractor* fail to complete the works by the *Date of Completion*, the period of time from the *Date of Completion* to the time until all required *Work* is performed completely as determined by the *Consultant*, shall be termed the Period of Delay.

In the event of there being a Period of Delay, the Contractor will be liable for and will pay to the *Owner* the cost of continuance of supervision during the Period of Delay, and all additional fees, disbursements and costs incurred by the *Owner* by reason of there being such Period of Delay for each and every calendar day that the work or works shall remain unfinished after the time so specified. The said sum or sums in view of the difficulty of ascertaining the losses which the *Owner* may suffer by reason of delay in the performance of the said Works, is hereby agreed upon, fixed and determined by the parties hereto as liquidated damages that the *Owner* will suffer by reason of said delay and default and not as penalty. The *Contractor* agrees to pay the Owner liquidated damages for each payment following the event until the project reaches Substantial Performance as certified by the *Consultant*.

In witness whereof the parties hereto have executed this Agreement and by the hands of their duly authorized representatives.

SIGNED AND DELIVERED
In the presence of:

OWNER

Town of Stratford
Name of Owner

WITNESS

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

CONTRACTOR

Name of Contractor

WITNESS

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

Signature

Name and Title of Person Signing

N.B. Where legal jurisdiction, local practice or Owner or Contractor requirements calls for (a) proof of authority to execute this document, attach such proof of authority in the form of a certified copy of a resolution naming the representative(s) authorized to sign the Agreement for and on behalf of the corporation or partnership; or (b) the affixing of a corporate seal, this Agreement should be properly sealed.

END OF SECTION

DEFINITIONS

DEFINITIONS

The following definitions shall apply to all *Contract Documents*.

1. Change Directive

A *Change Directive* is a written instruction prepared by the *Consultant* and signed by the *Owner* directing the *Contractor* to proceed with a change in the *Work* within the general scope of the *Contract Documents* prior to the *Owner* and the *Contractor* agreeing upon an adjustment in *Contract Price* and *Contract Time* .

2. Change Order

A *Change Order* is a written amendment to the *Contract* prepared by the *Consultant* and signed by the *Owner* and the *Contractor* stating their agreement upon:

- a change in the *Work*;
- the method of adjustment or the amount of the adjustment in the *Contract Price*, if any; and
- the extent of the adjustment in the *Contract Time*, if any.

3. Construction Equipment

Construction Equipment means all machinery and equipment, either operated or not operated, that is required for preparing, fabricating, conveying, erecting, or otherwise performing the *Work* but is not incorporated into the *Work*.

4. Consultant

The *Consultant* is the person or entity identified as such in the Agreement. The *Consultant* is the Engineer or other entity licensed to practise in the province or territory of the *Place of the Work*. The term *Consultant* means the *Consultant* or the *Consultant*'s authorized representative.

5. Contract

The *Contract* is the undertaking by the parties to perform their respective duties, responsibilities, and obligations as prescribed in the *Contract Documents* and represents the entire agreement between the parties.

6. Contract Documents

The *Contract Documents* consist of those documents listed in Article A-3 of the Agreement - CONTRACT DOCUMENTS and amendments agreed upon between the parties.

7. Contract Price

When *Unit Prices* form the basis of payment, the *Contract Price* is the sum of the product of each *Unit Price* stated in the *Schedule of Prices* multiplied by the appropriate actual quantity of each item that is incorporated in or made necessary by the Work, plus lump sums, if any, and allowances, if any, stated in the *Schedule of Prices*. When a lump sum stipulated price forms the basis of payment, the *Contract Price* is the amount stipulated in Article A-4 of the Agreement - CONTRACT PRICE.

8. Contract Time

The *Contract Time* is the time stipulated in paragraph 1.3 of Article A-1 of the Agreement - THE WORK from commencement of the *Work* to *Substantial Performance of the Work.*

9. Contractor

The *Contractor* is the person or entity identified as such in the Agreement. The term *Contractor* means the *Contractor* or the *Contractor*'s authorized representative as designated to the *Owner* in writing.

10. Drawings

The *Drawings* are the graphic and pictorial portions of the *Contract Documents*, wherever located and whenever issued, showing the design, location, and dimensions of the *Work*, generally including plans, elevations, sections, details, schedules, and diagrams.

11. Owner

The *Owner* is the person or entity identified as such in the Agreement. The term *Owner* means the *Owner* or the *Owner*'s authorized agent or representative as designated to the *Contractor* in writing, but does not include the *Consultant*.

12. Place of the Work

The *Place of the Work* is the designated site or location of the *Work* identified in the *Contract Documents*.

13. Product

Product or *Products* means material, machinery, equipment, and fixtures forming the *Work*, but does not include *Construction Equipment*.

14. Project

The *Project* means the total construction contemplated of which the *Work* may be the whole or a part.

15. Provide

Provide means to supply and install.

16. Schedule of Prices

The *Schedule of Prices* is the schedule listed in Article A-3 - CONTRACT DOCUMENTS identifying items of work, estimated quantities, units of measure, and *Unit Prices*.

17. Shop Drawings

Shop Drawings are drawings, diagrams, illustrations, schedules, performance charts, brochures, *Product* data, and other data which the *Contractor* provides to illustrate details of portions of the *Work*.

18. Specifications

The *Specifications* are that portion of the *Contract Documents*, wherever located and whenever issued, consisting of the written requirements and standards for *Products*, systems, workmanship, and the services necessary for the performance of the *Work*.

19. Subcontractor

A *Subcontractor* is a person or entity having a direct contract with the *Contractor* to perform a part or parts of the *Work*, or to supply *Products* worked to a special design for the *Work*.

20. Substantial Performance of the Work

Substantial Performance of the Work is as defined in the lien legislation applicable to the *Place of the Work*. If such legislation is not in force or does not contain such definition, or if the *Work* is governed by the Civil Code of Quebec, *Substantial Performance of the Work* shall have been reached when the *Work* is ready for use or is being used for the purpose intended and is so certified by the *Consultant*.

21. Supplemental Instruction

A *Supplemental Instruction* is an instruction, not involving adjustment in the *Contract Price* or *Contract Time*, in the form of *Specifications*, *Drawings*, schedules, samples, models, or written instructions, consistent with the intent of the *Contract Documents*. It is to be issued by the *Consultant* to supplement the *Contract Documents* as required for the performance of the *Work*.

22. Supplier

A *Supplier* is a person or entity having a direct contract with the *Contractor* to supply *Products* not worked to a special design for the *Work*.

23. Temporary Work

Temporary Work means temporary supports, structures, facilities, services, and other temporary things, excluding *Construction Equipment*, required for the execution of the *Work* but not incorporated into the *Work*.

24. Unit Price

A *Unit Price* is the amount payable for a single unit of work as stated in the *Schedule of Prices*.

25. Value Added Taxes

Value Added Taxes means such sum as shall be levied upon the *Contract Price* by the Federal or any Provincial or Territorial Government and is computed as a percentage of the *Contract Price* and includes the Goods and Services Tax, the Quebec Sales Tax, the Harmonized Sales Tax, and any similar tax, the collection and payment of which is by the *Contractor* as imposed by the tax legislation.

26. Work

The *Work* means the total construction and related services required by the *Contract Documents*.

27. Working Day

Working Day means a day other than a Saturday, Sunday, statutory holiday or statutory vacation day that is observed by the construction industry in the area of the *Place of the Work*.

GENERAL CONDITIONS

GENERAL CONDITIONS OF THE CIVIL WORKS CONTRACT

PART 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

1.1.1 The intent of the *Contract Documents* is to include the labour, *Products*, and services necessary for the performance of the *Work* by the *Contractor* in accordance with these documents. It is not intended, however, that the *Contractor* shall supply products or perform work not consistent with, not covered by, or not properly inferable from the *Contract Documents*.

1.1.2 Except for the provisions of article 12.3.6, nothing contained in the *Contract Documents* shall create any contractual relationship between:

.1 the *Owner* and a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any of the *Work*.

.2 the *Consultant* and the *Contractor*, a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any of the *Work*.

1.1.3 The *Contract Documents* are complementary, and what is required by any one shall be as binding as if required by all.

1.1.4 Words and abbreviations which have well known technical or trade meanings are used in the *Contract Documents* in accordance with such recognized meanings.

1.1.5 References in the *Contract Documents* to the singular shall be considered to include the plural as the context requires.

1.1.6 Neither the organization of the *Specifications* nor the arrangement of *Drawings* shall control the *Contractor* in dividing the work among *Subcontractors* and *Suppliers*.

1.1.7 If there is a conflict within the *Contract Documents*:

.1 the order of priority of documents, from highest to lowest, shall be

- the Agreement between the *Owner* and the *Contractor*,
- the Definitions,
- Supplementary Conditions,
- the General Conditions,
- the *Specifications*,
- material and finishing schedules,
- the *Drawings*.

.2 *Drawings* of larger scale shall govern over those of smaller scale of the same date.

.3 dimensions shown on *Drawings* shall govern over dimensions scaled from *Drawings*.

.4 later dated documents shall govern over earlier documents of the same type.

1.1.8 The *Owner* shall provide the *Contractor*, without charge, sufficient copies of the *Contract Documents* to perform the *Work*.

1.1.9 *Specifications*, *Drawings*, models, and copies thereof furnished by the *Consultant* are and shall remain the *Consultant*'s property, with the exception of the signed *Contract* sets, which shall belong to each party to the *Contract*. All *Specifications*, *Drawings*, and models furnished by the *Consultant* are to be used only with respect to the *Work* and are not to be used on other work. These *Specifications*, *Drawings*, and models are not to be copied or altered in any manner without the written authorization of the *Consultant*.

1.1.10 Models furnished by the *Contractor* at the *Owner*'s expense are the property of the *Owner*.

GC 1.2 LAW OF THE CONTRACT

1.2.1 The law of the *Place of the Work* shall govern the interpretation of the *Contract*.

GC 1.3 RIGHTS AND REMEDIES

1.3.1 Except as expressly provided in the *Contract Documents*, the duties and obligations imposed by the *Contract Documents* and the rights and remedies available thereunder shall be in addition to and not a limitation of any duties, obligations, rights, and remedies otherwise imposed or available by law.

1.3.2 No action or failure to act by the *Owner*, *Consultant*, or *Contractor* shall constitute a waiver of any right or duty afforded any of them under the *Contract*, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

GC 1.4 ASSIGNMENT

1.4.1 Neither party to the *Contract* shall assign the *Contract* or a portion thereof without the written consent of the other, which consent shall not be unreasonably withheld.

PART 2 ADMINISTRATION OF THE CONTRACT

GC 2.1 AUTHORITY OF THE CONSULTANT

2.1.1 The *Consultant* will have authority to act on behalf of the *Owner* only to the extent provided in the *Contract Documents*, unless otherwise modified by written agreement as provided in paragraph 2.1.2.

2.1.2 The duties, responsibilities, and limitations of authority of the *Consultant* as set forth in the *Contract Documents* shall be modified or extended only with the written consent of the *Owner*, the *Contractor*, and the *Consultant*.

2.1.3 If the *Consultant*'s employment is terminated, the *Owner* shall immediately appoint or reappoint a *Consultant* against whom the *Contractor* makes no reasonable objection and whose status under the *Contract Documents* shall be that of the former *Consultant*.

GC 2.2 ROLE OF THE CONSULTANT

2.2.1 The *Consultant* will provide administration of the *Contract* as described in the *Contract Documents* during construction until issuance of the final certificate for payment, and subject to GC 2.1 - AUTHORITY OF THE CONSULTANT and with the *Owner*'s concurrence, from time to time until the completion of any correction of defects as provided in paragraph 12.3.3 of GC 12.3 - WARRANTY.

2.2.2 The *Consultant* may provide at the *Place of the Work*, one or more project representatives to assist in carrying out the *Consultant*'s responsibilities. The duties, responsibilities, and limitations of authority of such project representatives shall be as set forth in writing to the *Contractor*.

2.2.3 The *Consultant* will review the *Work* at intervals appropriate to the progress of construction to:

.1 become familiar with the progress and quality of the *Work*,

.2 determine if the *Work* is proceeding in general conformity with the *Contract Documents*, and

.3 verify quantities of *Work* performed under a *Schedule of Prices*.

2.2.4 Based on the *Consultant*'s observations and evaluation of the *Contractor*'s applications for payment, the *Consultant* will determine the amounts owing to the *Contractor* under the *Contract* and will issue certificates for payment as provided in Article A-5 of the Agreement - PAYMENT, GC 5.3 - PROGRESS PAYMENT, and GC 5.7 - FINAL PAYMENT.

2.2.5 The *Consultant* will not be responsible for and will not have control, charge, or supervision of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs required in connection with the *Work* in accordance with the applicable construction safety legislation, other regulations, or general construction practice. The *Consultant* will not be responsible for the *Contractor*'s failure to carry out the *Work* in accordance with the *Contract Documents*. The *Consultant* will not have control over, charge of, or be responsible for the acts or omissions of the *Contractor*, *Subcontractors*, *Suppliers*, or their agents, employees, or any other persons performing portions of the *Work*.

2.2.6 The *Consultant* will be, in the first instance, the interpreter of the requirements of the *Contract Documents* and shall make findings as to the performance thereunder by both parties to the *Contract*, except with respect to GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER. Interpretations and findings of the *Consultant* shall be consistent with the intent of the *Contract Documents*. When making such interpretations and findings the *Consultant* will not show partiality to either the *Owner* or the *Contractor*.

2.2.7 Matters in question relating to the performance of the Work or the interpretation of the *Contract Documents*, except for GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER, shall be referred initially to the *Consultant* by notice in writing given to the *Consultant* and to the other party for the *Consultant*'s interpretation and finding which will be be given by notice in writing to the parties within a reasonable time. With respect to claims, the *Consultant* will make findings as set out in GC 6.6 - CLAIMS, paragraph 6.6.5.

2.2.8 The *Consultant* will have authority to reject work which in the *Consultant*'s opinion does not conform to the requirements of the *Contract Documents*. Whenever the *Consultant* considers it necessary or advisable, the *Consultant* will have authority to require inspection or testing of work, whether or not such work is fabricated, installed, or completed. However, neither the authority of the *Consultant* to act nor any decision either to exercise or not to exercise such authority shall give rise to any duty or responsibility of the *Consultant* to the *Contractor*, *Subcontractors*, *Suppliers,* or their agents, employees, or other persons performing any of the *Work*.

2.2.9 During the progress of the *Work* the *Consultant* will furnish *Supplemental Instructions* to the *Contractor* with reasonable promptness or in accordance with a schedule for such instructions agreed to by the *Consultant* and the *Contractor*.

2.2.10 The *Consultant* will review and take appropriate action upon such *Contractor*'s submittals as *Shop Drawings*, *Product* data, and samples, as provided in the *Contract Documents*.

2.2.11 The *Consultant* will prepare *Change Orders* and *Change Directives* as provided in GC 6.2 - CHANGE ORDER and GC 6.3 - CHANGE DIRECTIVE.

2.2.12 The *Consultant* will conduct reviews of the *Work* to determine the date of *Substantial Performance of the Work* as provided in GC 5.4 - SUBSTANTIAL PERFORMANCE OF THE WORK.

2.2.13 All certificates issued by the *Consultant* will be to the best of the *Consultant*'s knowledge, information, and belief. By issuing any certificate, the *Consultant* does not guarantee the *Work* is correct or complete.

2.2.14 The *Consultant* will receive and review written warranties and related documents required by the *Contract* and provided by the *Contractor* and will forward such warranties and documents to the *Owner* for the *Owner*'s acceptance.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

2.3.1 The *Owner* and the *Consultant* shall have access to the *Work* at all times. The *Contractor* shall provide sufficient, safe, and proper facilities at all times for the review of the *Work* by the *Consultant* and the inspection of the *Work* by authorized agencies. If parts of the *Work* are in preparation at locations other than the *Place of the Work*, the *Owner* and the *Consultant* shall be given access to such work whenever it is in progress.

2.3.2 If work is designated for tests, inspections, or approvals in the *Contract Documents*, or by the *Consultant*'s instructions, or the laws or ordinances of the *Place of the Work*, the *Contractor* shall give the *Consultant* reasonable notice of when the work will be ready for review and inspection. The *Contractor* shall arrange for and shall give the *Consultant* reasonable notice of the date and time of inspections by other authorities.

2.3.3 The *Contractor* shall furnish promptly to the *Consultant* two copies of certificates and inspection reports relating to the *Work*.

2.3.4 If the *Contractor* covers, or permits to be covered, work that has been designated for special tests, inspections, or approvals before such special tests, inspections, or approvals are made, given or completed, the *Contractor* shall, if so directed, uncover such work, have the inspections or tests satisfactorily completed, and make good covering work at the *Contractor*'s expense.

2.3.5 The *Consultant* may order any portion or portions of the *Work* to be examined to confirm that such work is in accordance with the requirements of the *Contract Documents*. If the work is not in accordance with the requirements of the *Contract Documents*, the *Contractor* shall correct the work and pay the cost of examination and correction. If the work is in accordance with the requirements of the *Contract Documents*, the *Owner* shall pay the cost of examination and restoration.

2.3.6 The *Contractor* shall pay the cost of making any test or inspection, including the cost of samples required for such test or inspection, if such test or inspection is designated in the *Contract Documents* to be performed by the *Contractor* or is designated by the laws or ordinances of the *Place of the Work*.

2.3.7 The *Contractor* shall pay the cost of samples required for any test or inspection to be performed by the *Consultant* or the *Owner* if such test or inspection is designated in the *Contract Documents*.

GC 2.4 DEFECTIVE WORK

2.4.1 The *Contractor* shall promptly remove from the *Place of the Work* and replace or re-execute defective work that has been rejected by the *Consultant* as failing to conform to the *Contract Documents* whether or not the defective work has been incorporated in the *Work* and whether or not the defect is the result of poor workmanship, use of defective products, or damage through carelessness or other act or omission of the *Contractor*.

2.4.2 The *Contractor* shall make good promptly other contractors' work destroyed or damaged by such removals or replacements at the *Contractor*'s expense.

2.4.3 If in the opinion of the *Consultant* it is not expedient to correct defective work or work not performed as provided in the *Contract Documents*, the *Owner* may deduct from the amount otherwise due to the *Contractor* the difference in value between the work as performed and that called for by the *Contract Documents*. If the *Owner* and the *Contractor* do not agree on the difference in value, they shall refer the matter to the *Consultant* for a determination.

PART 3 EXECUTION OF THE WORK

GC 3.1 CONTROL OF THE WORK

3.1.1 The *Contractor* shall have total control of the *Work* and shall effectively direct and supervise the *Work* so as to ensure conformity with the *Contract Documents*.

3.1.2 The *Contractor* shall be solely responsible for construction means, methods, techniques, sequences, and procedures and for co-ordinating the various parts of the *Work* under the *Contract*.

GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

3.2.1 The *Owner* reserves the right to award separate contracts in connection with other parts of the *Project* to other contractors and to perform work with own forces.

3.2.2 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner*'s own forces, the *Owner* shall:

.1 provide for the co-ordination of the activities and work of other contractors and *Owner*'s own forces with the *Work* of the *Contract*;

.2 assume overall responsibility for compliance with the applicable health and construction safety legislation at the *Place of the Work*;

.3 enter into separate contracts with other contractors under conditions of contract which are compatible with the conditions of the *Contract*;

.4 ensure that insurance coverage is provided to the same requirements as are called for in GC 11.1 - INSURANCE and co-ordinate such insurance with the insurance coverage of the *Contractor* as it affects the *Work*; and

.5 take all reasonable precautions to avoid labour disputes or other disputes on the *Project* arising from the work of other contractors or the *Owner*'s own forces.

3.2.3 When separate contracts are awarded for other parts of the *Project*, or when work is performed by the *Owner*'s own forces, the *Contractor* shall:

.1 afford the *Owner* and other contractors reasonable opportunity to introduce and store products and use the *Owner*'s or other contractor's construction equipment to execute their work;

.2 cooperate with other contractors and the *Owner* in reviewing their construction schedules; and

.3 where part of the *Work* is affected by or depends upon for its proper execution the work of other contractors or *Owner*'s own forces, promptly report to the *Consultant* in writing and prior to proceeding with that part of the *Work*, any apparent deficiencies in such work

3.2.4 Where the *Contract Documents* identify the work to be performed by other contractors or the *Owner*'s own forces, the *Contractor* shall coordinate and schedule the *Work* with the work of other contractors and the *Owner*'s own forces and interface as specified in the *Contract Documents*.

3.2.5 Where a change in the *Work* is required as a result of the co-ordination and interface of the work of other contractors or *Owner*'s own forces with the *Work*, the changes shall be authorized and valued as provided in GC 6.1 - CHANGES, GC 6.2 - CHANGE ORDER, and GC 6.3 - CHANGE DIRECTIVE.

3.2.6 Disputes, and other matters in question between the *Contractor* and other contractors shall be dealt with as provided in Part 8 of the General Conditions - DISPUTE RESOLUTION provided the other contractors have reciprocal obligations. The *Contractor* shall be deemed to have consented to arbitration of any dispute with any other contractor whose contract with the *Owner* contains a similar agreement to arbitrate.

GC 3.3 TEMPORARY WORK

3.3.1 The *Contractor* shall have the sole responsibility for the design, erection, operation, maintenance, and removal of *Temporary Work.*

3.3.2 The *Contractor* shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform those functions referred to in paragraph 3.3.1 where required by law or by the *Contract Documents* and in all cases where such *Temporary Work* is of such a nature that professional engineering skill is required to produce safe and satisfactory results.

3.3.3 Notwithstanding the provisions of GC 3.1 -CONTROL OF THE WORK, paragraph 3.3.1, and paragraph 3.3.2 or provisions to the contrary elsewhere in the *Contract Documents* where such *Contract Documents* include designs for *Temporary Work* or specify a method of construction in whole or in part, such designs or methods of construction shall be considered to be part of the design of the *Work* and the *Contractor* shall not be held responsible for that part of the design or the specified method of construction. The *Contractor* shall, however, be responsible for the execution of such design or specified method of construction in the same manner as for the execution of the *Work*.

GC 3.4 DOCUMENT REVIEW

3.4.1 The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency, or omission the *Contractor* may discover. Such review by the *Contractor* shall be to the best of the *Contractor*'s knowledge, information, and belief and in making such review the *Contractor* does not assume any responsibility to the *Owner* or the *Consultant* for the accuracy of the review. The *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents,* which the *Contractor* did not discover. If the *Contractor* does discover any error, inconsistency, or omission in the *Contract Documents*, the *Contractor* shall not proceed with the work affected until the *Contractor* has received corrected or missing information from the *Consultant*.

GC 3.5 CONSTRUCTION SCHEDULE

3.5.1 The *Contractor* shall:

.1 prepare and submit to the *Owner* and the *Consultant* prior to the first application for payment, a construction schedule that indicates the timing of the major activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time*;

.2 monitor the progress of the *Work* relative to the construction schedule and update the schedule on a monthly basis or as stipulated by the *Contract Documents*; and

.3 advise the *Consultant* of any revisions required to the schedule as the result of extensions of the *Contract Time* as provided in Part 6 of the General Conditions - CHANGES IN THE WORK.

GC 3.6 SUPERVISION

3.6.1 The *Contractor* shall provide all necessary supervision and appoint a competent representative who shall be in attendance at the *Place of the Work* while the *Work* is being performed. The appointed representative shall not be changed except for valid reason.

3.6.2 The appointed representative shall represent the *Contractor* at the *Place of the Work* and notices and instructions given to the appointed representative by the *Consultant* shall be held to have been received by the *Contractor*.

GC 3.7 LAYOUT OF THE WORK

3.7.1 The *Owner* shall, in consultation with the Contractor, establish reference points for construction which are necessary for the *Contractor* to proceed with the *Work*.

3.7.2 The *Contractor* shall be responsible for laying out the *Work*, shall preserve and protect the established reference points, and shall not change or relocate the established reference points without the approval of the *Consultant*.

3.7.3 The *Contractor* shall advise the *Consultant* whenever any established reference point is lost, destroyed, damaged, or requires relocation as a result of the *Contractor*'s operations. The cost to reestablish any reference point that is lost, destroyed, damaged, or requires relocation as a result of the *Contractor*'s operations, shall be at the *Contractor*'s expense.

GC 3.8 SUBCONTRACTORS AND SUPPLIERS

3.8.1 The *Contractor* shall preserve and protect the rights of the parties under the *Contract* with respect to work to be performed under subcontract, and shall:

.1 enter into contracts or written agreements with *Subcontractors* and *Suppliers* to require them to perform their work as provided in the *Contract Documents*;

.2 incorporate the terms and conditions of the *Contract Documents* into all contracts or written agreements with *Subcontractors* and *Suppliers*; and

.3 be as fully responsible to the *Owner* for acts and omissions of *Subcontractors*, *Suppliers*, and of persons directly or indirectly employed by them as for acts and omissions of persons directly employed by the *Contractor*.

3.8.2 The *Contractor* shall indicate in writing, at the request of the *Owner*, those *Subcontractors* or *Suppliers* whose bids have been received by the *Contractor* which the *Contractor* would be prepared to accept for the performance of a portion of the *Work*. Should the *Owner* not object before signing the *Contract*, the *Contractor* shall employ those *Subcontractors* or *Suppliers* so identified by the *Contractor* in writing for the performance of that portion of the *Work* to which their bid applies.

3.8.3 The *Owner* may, for reasonable cause, at any time before the *Owner* has signed the *Contract*, object to the use of a proposed *Subcontractor* or *Supplier* and require the *Contractor* to employ one of the other subcontract bidders.

3.8.4 If the *Owner* requires the *Contractor* to change a proposed *Subcontractor* or *Supplier*, the *Contract Price* and *Contract Time* shall be adjusted by the differences occasioned by such required change.

3.8.5 The *Contractor* shall not be required to employ as a *Subcontractor* or *Supplier*, a person or firm to which the *Contractor* may reasonably object.

3.8.6 The *Owner*, through the *Consultant*, may provide to a *Subcontractor* or *Supplier* information as to the percentage of the *Subcontractor*'s or *Supplier*'s work which has been certified for payment.

GC 3.9 LABOUR AND PRODUCTS

3.9.1 The *Contractor* shall provide and pay for labour, *Products*, tools, *Construction Equipment*, water, heat, light, power, transportation, and other facilities and services necessary for the performance of the *Work* in accordance with the *Contract*.

3.9.2 *Products* provided shall be new. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*.

3.9.3 The *Contractor* shall maintain good order and discipline among the *Contractor*'s employees engaged on the *Work* and shall not employ on the *Work* anyone not skilled in the tasks assigned.

GC 3.10 DOCUMENTS AT THE SITE

3.10.1 The *Contractor* shall keep one copy of current *Contract Documents*, submittals, reports, and records of meetings at the *Place of the Work*, in good order and available to the *Owner* and the *Consultant*.

GC 3.11 SHOP DRAWINGS

3.11.1 The *Contractor* shall provide *Shop Drawings* as required in the *Contract Documents*.

3.11.2 The *Contractor* shall review all *Shop Drawings* prior to submission to the *Consultant*. The *Contractor* represents by this review that:

.1 the *Contractor* has determined and verified all field measurements, field construction conditions, materials, *Product* requirements, catalogue numbers, and similar data or will do so; and

.2 the *Contractor* has checked and co-ordinated each *Shop Drawing* with the requirements of the *Contract Documents*.

3.11.3 The *Contractor* shall confirm the review of each shop drawing by stamp, date, and signature of the person responsible for the review. At the time of submission the *Contractor* shall notify the *Consultant* in writing of any deviations in the *Shop Drawings* from the requirements of the *Contract Documents*.

3.11.4 The *Contractor* shall submit *Shop Drawings* to the *Consultant* to review in orderly sequence and sufficiently in advance so as to cause no delay in the *Work* or in the work of other contractors. Upon request of the *Contractor* or the *Consultant*, they jointly shall prepare a schedule of the dates for submission and return of *Shop Drawings*. *Shop Drawings* which require approval of any legally constituted authority having jurisdiction shall be submitted to such authority by the *Contractor* for approval.

3.11.5 The *Contractor* shall submit *Shop Drawings* in the form specified or as the *Consultant* may direct. The *Consultant* will review and return *Shop Drawings* in accordance with the schedule agreed upon, or otherwise with reasonable promptness so as to cause no delay. The *Consultant*'s review is for conformity to the design concept and for general arrangement only. The *Consultant*'s review shall not relieve the *Contractor* of responsibility for errors or omissions in the *Shop Drawings* or for meeting all requirements of the *Contract Documents* unless the *Consultant* expressly notes the acceptance of a deviation on the *Shop Drawings*.

3.11.6 Upon the *Consultant*'s request, the *Contractor* shall revise and resubmit *Shop Drawings* which the *Consultant* rejects as inconsistent with the *Contract Documents* unless otherwise directed by the *Consultant*. The *Contractor* shall notify the *Consultant* in writing of any revisions to the resubmission other than those requested by the *Consultant*.

GC 3.12 USE OF THE WORK

3.12.1 The *Contractor* shall confine *Construction Equipment, Temporary Work*, storage of *Products*, waste products and debris, and operations of employees to limits indicated by laws, ordinances, permits, or the *Contract Documents* and shall not unreasonably encumber the *Place of Work* with *Products*.

3.12.2 The *Contractor* shall not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety of the *Work*.

GC 3.13 CUTTING AND REMEDIAL WORK

3.13.1 The *Contractor* shall do the cutting and remedial work required to make the several parts of the *Work* come together properly.

3.13.2 The *Contractor* shall co-ordinate the *Work* to ensure that this requirement is kept to a minimum.

3.13.3 Should the *Owner*, the *Consultant*, other contractors or anyone employed by them be responsible for ill-timed work necessitating cutting or remedial work to be performed, the cost of such cutting or remedial work shall be valued as provided in GC 6.1 - CHANGES, GC 6.2 - CHANGE ORDER, and GC 6.3 - CHANGE DIRECTIVE.

3.13.4 Cutting and remedial work shall be performed by specialists familiar with the *Products* affected and shall be performed in a manner to neither damage nor endanger the *Work*.

GC 3.14 CLEANUP

3.14.1 The *Contractor* shall maintain the *Work* in a safe and tidy condition and free from the accumulation of waste products and debris, other than that caused by the *Owner*, other contractors or their employees.

3.14.2 Before applying for *Substantial Performance of the Work* as provided in GC 5.7 - SUBSTANTIAL PERFORMANCE OF THE WORK, the *Contractor* shall remove waste products and debris, other than that resulting from the work of the *Owner*, other contractors or their employees, and shall leave the *Work* clean and suitable for use or occupancy by the *Owner*. The *Contractor* shall remove products, tools, *Construction Equipment* and *Temporary Work* not required for the performance of the remaining work.

3.14.3 Prior to application for the final certificate for payment, the *Contractor* shall remove any remaining products, tools, *Construction Equipment, Temporary Work,* and waste products and debris, other than those resulting from the work of the *Owner*, other contractors or their employees.

PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

4.1.1 The *Contract Price* includes the cash allowances, if any, stated in the *Contract Documents*. The scope of work or costs included in such cash allowances shall be as described in the *Contract Documents.*

4.1.2 The *Contract Price*, and not the cash allowances, includes the *Contractor*'s overhead and profit in connection with such cash allowances.

4.1.3 Expenditures under cash allowances shall be authorized by the *Owner* through the *Consultant.*

4.1.4 Where costs under any cash allowance exceed the amount of the allowance, the *Contractor* shall be compensated for the excess incurred and substantiated plus an amount for overhead and profit on the excess as set out in the *Contract Documents*. Where costs under any cash allowance are less than the amount of the allowance, the *Owner* shall be credited for the unexpended portion of the cash allowance, but not for the *Contractor*'s overhead and profit on such amount. Multiple cash allowances shall not be combined for the purpose of calculating the foregoing.

4.1.5 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between the actual cost and each cash allowance.

4.1.6 The value of the work performed under a cash allowance is eligible to be included in progress payments.

4.1.7 The *Contractor* and the *Consultant* shall jointly prepare a schedule that shows when the *Consultant* and *Owner* must authorize ordering of items called for under cash allowances to avoid delaying the progress of the *Work*.

GC 4.2 CONTINGENCY ALLOWANCE

4.2.1 The *Contract Price* includes the contingency allowance, if any, stated in the *Contract Documents*.

4.2.2 Expenditures under the contingency allowance shall be authorized and valued as provided in GC 6.1 - CHANGES, GC 6.2 - CHANGE ORDER, and GC 6.3 - CHANGE DIRECTIVE.

4.2.3 The *Contract Price* shall be adjusted by *Change Order* to provide for any difference between the expenditures authorized under paragraph 4.2.2 and the contingency allowance.

PART 5 PAYMENT

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

5.1.1 The *Owner* shall, at the request of the *Contractor*, before signing the *Contract*, and promptly from time to time thereafter, furnish to the *Contractor* reasonable evidence that financial arrangements have been made to fulfill the *Owner*'s obligations under the *Contract*.

5.1.2 The *Owner* shall notify the *Contractor* in writing of any material change in the *Owner*'s financial arrangements during performance of the *Contract*.

GC 5.2 BASIS OF PAYMENT FOR UNIT PRICE WORK

5.2.1 Payment for *Unit Price* work shall be based on the *Unit Prices* in the *Contract*.

5.2.2 The *Contractor* shall measure the *Work* and the *Consultant* will verify such measurements to determine payment to the *Contractor* in accordance with the measurement provisions of the *Contract Documents*.

GC 5.3 BASIS OF PAYMENT FOR LUMP SUM WORK

5.3.1 Payment for lump sum work shall be based on the stipulated price(s) in the *Contract*.

GC 5.4 BASIS OF PAYMENT FOR COST PLUS WORK

5.4.1 Payment for cost plus work shall be based on the cost of such work, as provided in paragraph 5.4.2, plus a fee calculated as a percentage of the cost of such work, for the *Contractor*'s overhead and profit. The percentage amount shall be as provided in the *Contract Documents* but shall not be applied to the cost of *Construction Equipment* when such cost is based on rates which already include the *Contractor*'s overhead and profit.

5.4.2 The cost of cost plus work shall be at rates prevailing in the locality of the *Place of the Work* and shall include the following cost elements as applicable to such work:

.1 wages and benefits paid for labour in the direct employ of the *Contractor* under applicable collective bargaining agreements, or under a salary or wage schedule agreed upon by the *Owner* and *Contractor*;

.2 salaries, wages, and benefits of the *Contractor*'s personnel, when stationed at the field office, in whatever capacity employed; or personnel at shops or on the road, engaged in expediting the production or transportation of materials or equipment;

.3 contributions, assessments, or taxes incurred for such items as employment insurance, provincial or territorial health insurance, workers' compensation, and Canada or Quebec Pension Plan, insofar as such cost is based on wages, salaries, or other remuneration paid to employees of the *Contractor* and included in the cost of the *Work* as provided in paragraphs 5.4.2.1 and 5.4.2.2:

.4 travel and subsistence expenses of the *Contractor*'s personnel described in paragraphs 5.4.2.1 and 5.4.2.2;

.5 the cost of all *Products* including cost of transportation thereof;

.6 the cost of materials, supplies, *Construction Equipment*, *Temporary Work*, and hand tools not owned by the workers, including transportation, and maintenance thereof, which are consumed in the performance of the *Work*; and cost less salvage value on such items used but not consumed, which remain the property of the *Contractor*;

.7 the cost of all tools and *Construction Equipment*, exclusive of hand tools used in the performance of the *Work*, whether rented from or provided by the *Contractor* or others, including installation, minor repairs and replacements, dismantling, removal, transportation and delivery cost thereof;

.8 deposits lost;

.9 the amounts of all subcontracts;

.10 the cost of quality assurance such as independent inspection and testing services;

.11 charges levied by authorities having jurisdiction at the *Place of the Work*;

.12 royalties, patent license fees, and damages for infringement of patents and cost of defending suits therefor subject always to the *Contractor*'s obligations to indemnify the *Owner* as provided in paragraph 10.3.1 of GC 10.3 - PATENT FEES;

.13 any adjustment in premiums for all bonds and insurance which the *Contractor* is required, by the *Contract Documents*, to purchase and maintain;

.14 any adjustment in taxes and duties for which the *Contractor* is liable;

.15 charges for long distance telephone and facsimile communications, courier services, expressage, and petty items incurred in relation to the performance of the *Work*;

.16 the cost of removal and disposal of waste products and debris; and

.17 cost incurred due to emergencies affecting the safety of persons or property.

5.4.3 The *Contractor* shall obtain the *Owner's* approval prior to subcontracting or entering into other agreements for cost plus work.

5.4.4 The *Consultant* may refuse to certify payment for all or part of the cost of any item under any cost element, where the item in question was unsuitable, unnecessary or the cost was otherwise improperly incurred in the performance of the Work.

5.4.5 The *Contractor* shall keep full and detailed accounts and records necessary for the documentation of the cost of cost plus work and shall provide the *Consultant* with copies thereof when requested.

5.4.6 The *Owner* shall be afforded reasonable access to all of the *Contractor*'s books, records, correspondence, instructions, drawings, receipts, vouchers, and memoranda related to the cost of cost plus work, and for this purpose the *Contractor* shall preserve such records for a period of one year from the date of *Substantial Performance of the Work*.

GC 5.5 APPLICATIONS FOR PROGRESS PAYMENT

5.5.1 Applications for payment on account as provided in Article A-5 of the Agreement - PAYMENT may be made monthly as the *Work* progresses.

5.5.2 Applications for payment shall be dated the last day of the agreed monthly payment period and the amount claimed shall be for the value, proportionate to the amount of the *Contract*, of work performed and *Products* delivered to the *Place of the Work* at that date.

5.5.3 Where the basis of payment of the *Contract Price* is *Unit Prices*, applications for payment shall include quantity measurements and any other data requested by the *Consultant* to assist the *Consultant* in evaluating the application and verifying quantity measurements.

5.5.4 Where the basis of payment of the *Contract Price* is a lump sum stipulated price:

.1 the *Contractor* shall submit to the *Consultant*, at least 10 *Working Days* before the first application for payment, a schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, so as to facilitate evaluation of applications for payment;

.2 the schedule of values shall be made out in such form and supported by such evidence as the *Consultant* may reasonably direct and when accepted by the *Consultant*, shall be used as the basis for applications for payment, unless it is found to be in error; and

.3 the *Contractor* shall include a statement based on the schedule of values with each application for payment.

5.5.5 Where the basis of payment for a portion of the *Work* is cost plus, applications for payment shall be based on the cost of the work performed plus the amount of the fee earned, in accordance with GC 5.4 - BASIS OF PAYMENT FOR COST PLUS WORK.

5.5.6 Applications for payment for *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall be supported by such evidence as the *Consultant* may reasonably require to establish the value and delivery of the *Products*.

GC 5.6 PROGRESS PAYMENT

5.6.1 The *Consultant* will issue to the *Owner*, no later than 5 *Working Days* after the receipt of an application for payment from the *Contractor* submitted in accordance with GC 5.2 - APPLICATIONS FOR PROGRESS PAYMENT, a certificate for payment in the amount applied for or in such other amount as the *Consultant* determines to be properly due. If the *Consultant* amends the application, the *Consultant* will promptly notify the *Contractor* in writing giving reasons for the amendment.

5.6.2 The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement - PAYMENT no later than 5 *Working Days* after the date of a certificate for payment issued by the *Consultant*.

5.6.3 Where the basis of payment of the *Contract Price* is *Unit Prices*, quantities for progress payments shall be considered approximate until final verification of quantities by the *Consultant*. A certificate for progress payment shall not be construed as the *Consultant's* final verification of quantities. Final verification of quantities will be made after all work of an item is completed.

GC 5.7 SUBSTANTIAL PERFORMANCE OF THE WORK

5.7.1 When the *Contractor* considers that the *Work* is substantially performed, or if permitted by the lien legislation applicable to the *Place of the Work* a designated portion thereof which the *Owner* agrees to accept separately is substantially performed, the *Contractor* shall prepare and submit to the *Consultant* a comprehensive list of items to be completed or corrected and apply for a review by the *Consultant* to establish *Substantial Performance of the Work* or substantial performance of the designated portion of the *Work*. Failure to include an item on the list does not alter the responsibility of the *Contractor* to complete the *Contract*.

5.7.2 No later than 15 *Working Days* after the receipt of the *Contractor*'s list and application, the *Consultant* will review the *Work* to verify the validity of the application and notify the *Contractor* whether the *Work* or the designated portion of the *Work* is substantially performed.

5.7.3 The *Consultant* will state the date of *Substantial Performance of the Work* or designated portion of the *Work* in a certificate.

5.7.4 Immediately following the issuance of the certificate of *Substantial Performance of the Work*, the *Contractor*, in consultation with the *Consultant*, shall establish a reasonable date for finishing the *Work*.

GC 5.8 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

5.8.1 After the issuance of the certificate of *Substantial Performance of the Work*, the *Contractor* shall:

.1 submit an application for payment of the holdback amount,

.2 submit a sworn or affirmed statement that all accounts for labour, subcontracts, *Products*, *Construction Equipment*, and other indebtedness which may have been incurred by the *Contractor* in the *Substantial Performance of the Work* and for which the *Owner* might in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified amount in dispute.

5.8.2 After the receipt of an application for payment from the *Contractor* and the sworn or affirmed statement as provided in paragraph 5.8.1, the *Consultant* will issue a certificate for payment of the holdback amount.

5.8.3 Where the holdback amount required by the applicable lien legislation has not been placed in a separate holdback account, the *Owner* shall, 5 *Working Days* prior to the expiry of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*, place the holdback amount in a bank account in the joint names of the *Owner* and the *Contractor*.

5.8.4 In the common law jurisdictions, the holdback amount authorized by the certificate for payment of the holdback amount is due and payable on the day following the expiration of the holdback period stipulated in the lien legislation applicable to the *Place of the Work*. Where lien legislation does not exist or apply, the holdback amount shall be due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between the parties. The *Owner* may retain out of the holdback amount any sums required by law to satisfy any liens against the *Work* or, if permitted by the lien legislation applicable to the *Place of the Work*, other third party monetary claims against the *Contractor* which are enforceable against the *Owner*.

5.8.5 In the Province of Quebec, the holdback amount authorized by the certificate for payment of the holdback amount is due and payable no later than 30 days after the issuance of the certificate. The *Owner* may retain out of the holdback amount any sums required to satisfy any legal hypothecs that have been taken, or could be taken, against the *Work* or other third party monetary claims against the *Contractor* which are enforceable against the *Owner*.

GC 5.9 PROGRESSIVE RELEASE OF HOLDBACK

5.9.1 In the common law jurisdictions, where legislation permits and where, upon application by the *Contractor*, the *Consultant* has certified that the work of a *Subcontractor* or *Supplier* has been performed prior to *Substantial Performance of the Work*, the *Owner* shall pay the *Contractor* the holdback amount retained for such subcontract work, or the *Products* supplied by such *Supplier*, on the first *Working Day* following the expiration of the holdback period for such work stipulated in the lien legislation applicable to the *Place of the Work*.

5.9.2 In the Province of Quebec, where, upon application by the *Contractor*, the *Consultant* has certified that the work of a *Subcontractor* or *Supplier* has been performed prior to *Substantial Performance of the Work*, the *Owner* shall pay the *Contractor* the holdback amount retained for such subcontract work, or the *Products* supplied by such *Supplier*, no later than 30 days after such certification by the *Consultant*. The *Owner* may retain out of the holdback amount any sums required to satisfy any legal hypothecs that have been taken, or could be taken, against the *Work* or other third party monetary claims against the *Contractor* which are enforceable against the *Owner*.

5.9.2 Notwithstanding the provisions of the preceding paragraph, and notwithstanding the wording of such certificates, the *Contractor* shall ensure that such subcontract work or *Products* is protected pending the issuance of a final certificate for payment and be responsible for the correction of defects or work not performed regardless of whether or not such was apparent when such certificates were issued.

GC 5.10 FINAL PAYMENT

5.10.1 When the *Contractor* considers that the *Work* is completed, the *Contractor* shall submit an application for final payment.

5.10.2 The *Consultant* will, no later than 15 *Working Days* after the receipt of an application from the *Contractor* for final payment, review the *Work* to verify the validity of the application and notify the *Contractor* that the application is valid or give reasons why it is not valid.

5.10.3 When the *Consultant* finds the *Contractor*'s application for final payment valid, the *Consultant* will promptly issue a final certificate for payment.

5.10.4 Subject to the provision of paragraph 10.4.1 of GC 10.4 - WORKERS' COMPENSATION, and any lien legislation applicable to the *Place of the Work*, the *Owner* shall, no later than 5 *Working Days* after the issuance of a final certificate for payment, pay the *Contractor* as provided in Article A-5 of the Agreement - PAYMENT.

GC 5.11 WITHHOLDING OF PAYMENT

5.11.1 If because of climatic or other conditions reasonably beyond the control of the *Contractor*, there are items of work that cannot be performed, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such remaining work.

GC 5.12 NON-CONFORMING WORK

5.12.1 No payment by the *Owner* under the *Contract* nor partial or entire use or occupancy of the *Work* by the *Owner* shall constitute an acceptance of any portion of the *Work* or *Products* which are not in accordance with the requirements of the *Contract Documents*.

PART 6 CHANGES

GC 6.1 CHANGES

6.1.1 The *Owner*, through the *Consultant*, without invalidating the *Contract*, may make:
- .1 changes in the *Work* consisting of additions, deletions, or other revisions to the *Work* by *Change Order* or *Change Directive, and*
- .2 changes to the *Contract Time* for the *Work*, or any part thereof, by *Change Order.*

6.1.2 The *Contractor* shall not perform a change in the *Work* without a *Change Order* or a *Change Directive.*

GC 6.2 CHANGE ORDER

6.2.1 When a change in the *Work* or the *Contract Time* is proposed or required, the *Consultant* will provide notice in writing to the Contractor describing the proposed change. The *Contractor* shall present, in a form acceptable to the *Consultant*, a method of adjustment or an amount of adjustment of the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change.

6.2.2 The method of adjustment of the *Contract Price* presented by the *Contractor* may be:
- .1 *Unit Prices* listed in the *Schedule of Prices* that are applicable to the change in the *Work* or, if *Unit Prices* listed in the *Schedule of Prices* are not directly applicable, by unit prices deduced or extrapolated from such *Unit Prices*,
- .2 a lump sum or unit price quotation, or
- .3 the cost plus method as provided in GC 5.4 - BASIS OF PAYMENT FOR COST PLUS WORK.

6.2.3 When the *Owner* and *Contractor* agree to the adjustments in the *Contract Price* and *Contract Time* or to the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a *Change Order*, signed by *Owner* and *Contractor*. The value of the work performed as the result of a *Change Order* shall be included in applications for progress payment.

GC 6.3 CHANGE DIRECTIVE

6.3.1 If the *Owner* requires the *Contractor* to proceed with a change in the *Work* prior to the *Owner* and the *Contractor* agreeing upon the adjustment in *Contract Price* and *Contract Time*, the *Owner*, through the *Consultant*, shall issue a *Change Directive.*

6.3.2 A *Change Directive* shall only be used by the *Owner* to direct a change in the *Work* that is within the general scope of the *Contract Documents.*

6.3.3 Upon receipt of a *Change Directive*, the *Contractor* shall proceed promptly with the change in the *Work.*

6.3.4 The adjustment in the *Contract Price* for a change in the *Work* carried out by way of a *Change Directive* shall be on the basis of the *Contractor's* actual expenditures and savings attributable to the change. If a change in the *Work* results in expenditures only, the change in the *Work* shall be valued as cost plus work in accordance with GC 5.4 - BASIS OF PAYMENT FOR COST PLUS WORK.

6.3.5 If a change in the *Work* results in savings only, the amount of the credit shall be the actual cost savings to the *Contractor*, without deduction for overhead or profit.

6.3.6 If a change in the *Work* results in both expenditures and savings, the change in the *Work* shall be valued as specified in GC 6.3.4 and GC 6.3.5, except that overhead and profit on the cost plus work shall be payable only on the net increase, if any, with respect to that change in the Work.

6.3.7 Pending determination of the final amount of a *Change Directive*, the undisputed value of the work performed as the result of a *Change Directive* is eligible to be included in progress payments.

6.3.8 If the *Owner* and *Contractor* do not agree on the proposed adjustment in the *Contract Time* or the method of determining it, the adjustment shall be referred to the *Consultant* for determination.

6.3.9 If at any time after the start of the work directed by a *Change Directive*, the *Owner* and the *Contractor* reach agreement on the adjustment to the *Contract Price* and to the *Contract Time*, this agreement shall be recorded in a *Change Order* signed by *Owner* and *Contractor*.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

6.4.1 If the *Owner* or the *Contractor* discover conditions at the *Place of the Work* which are:

.1 subsurface or otherwise concealed physical conditions which existed before the commencement of the *Work* which differ materially from those indicated in the *Contract Documents*; or

.2 physical conditions, other than conditions due to weather, that are of a nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the *Contract Documents*;

then the observing party shall notify the other party in writing before conditions are disturbed and in no event later than 5 *Working Days* after first observance of the conditions.

6.4.2 The *Consultant* will promptly investigate such conditions and make a finding. If the finding is that the conditions differ materially and this would cause an increase or decrease in the *Contractor*'s cost or time to perform the *Work*, the *Consultant*, with the *Owner*'s approval, will issue appropriate instructions for a change in the *Work* as provided in GC 6.2 - CHANGE ORDER or GC 6.3 - CHANGE DIRECTIVE.

6.4.3 If the *Consultant* finds that the conditions at the *Place of the Work* are not materially different or that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* will report the reasons for this finding to the *Owner* and the *Contractor* in writing.

6.4.4 The *Contractor* shall not be entitled to an adjustment in the *Contract Price* or the *Contract Time* if such conditions were reasonably apparent prior to the time of bid closing.

GC 6.5 DELAYS

6.5.1 If the *Contractor* is delayed in the performance of the *Work* by an action or omission of the *Owner*, *Consultant*, or anyone employed or engaged by them directly or indirectly, contrary to the provisions of the *Contract Documents*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.

6.5.2 If the *Contractor* is delayed in the performance of the *Work* by a stop work order issued by a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or any person employed or engaged by the *Contractor* directly or indirectly, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay.

6.5.3 If the *Contractor* is delayed in the performance of the *Work* by

.1 labour disputes, strikes, lock-outs (including lock-outs decreed or recommended for its members by a recognized contractors' association, of which the *Contractor* is a member or to which the *Contractor* is otherwise bound),

.2 fire, unusual delay by common carriers or unavoidable casualties,

.3 abnormally adverse weather conditions, or

.4 any other cause beyond the *Contractor*'s control, other than one resulting from a default of or breach of *Contract* by the *Contractor*,

then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from actions by the *Owner*.

6.5.4 No extension shall be made for delay unless notice in writing of the cause of delay is given to the *Consultant* not later than 10 *Working Days* after the commencement of delay, providing however, that in the case of a continuing cause of delay only one notice shall be necessary.

6.5.5 If no schedule is made under paragraph 2.2.9 of GC 2.2 - ROLE OF THE CONSULTANT, then no request for extension shall be made because of failure of the *Consultant* to furnish instructions until 10 *Working Days* after demand for such instructions has been made and not then, unless the request is reasonable.

GC6.6 CLAIMS

6.6.1 If the *Contractor* intends to make a claim for additional payment, or if the *Owner* intends to make a claim for a credit to the *Contract Price* or for damages of any kind, the party that intends to make the claim shall give notice in writing of intent to claim to the other party and to the *Consultant* as soon as practicable, but no later than 10 *Working Days* after commencement of the event or series of events giving rise to the claim. Failure to provide such notification shall invalidate the claim.

6.6.2 Upon commencement of the event or series of events giving rise to the claim, the party intending to make a claim shall:

.1 take all reasonable measures to mitigate any loss or damage which may be incurred as a result of such event or series of events, and

.2 keep such records as may be necessary to support the claim.

6.6.3 Within 30 *Working Days* after commencement of the event or series of events giving rise to the claim, or such other reasonable time as may be agreed by the *Consultant*, the party making the claim shall submit to the *Consultant* a detailed account of the amount claimed and the grounds upon which the claim is based.

6.6.4 Where the event or series of events giving rise to the claim has a continuing effect, the detailed account submitted under paragraph 6.6.3 shall be considered to be an interim account and the party making the claim shall, at such intervals as the *Consultant* may reasonably require, submit further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. The party making the claim shall submit a final account with 30 *Working Days* after the end of the effects resulting from the event or series of events.

6.6.5 The *Consultant's* findings, with respect to a claim made by either party, will be given by notice in writing to the other party within 30 *Working Days* after receipt thereof by the *Consultant*, or such other time period as may be agreed by the parties. If such finding is not acceptable to both parties, the claim shall be settled in accordance with Part 8 of the General Conditions - DISPUTE RESOLUTION.

GC 6.7 QUANTITY VARIATIONS

6.7.1 The *Owner* or the *Contractor* may request an adjustment to a *Unit Price* contained in a *Schedule of Prices* included in the *Contract* provided that the actual quantity of the item in the *Schedule of Prices* exceeds or falls short of the estimated quantity by more that 15%.

6.7.2 Where the actual quantity exceeds the estimated quantity by more than 15%, a *Unit Price* adjusted pursuant to paragraph 6.7.1 shall apply only to the quantity that exceeds 115% of the estimated quantity.

6.7.3 Where the actual quantity falls short of the estimated quantity by more than 15%, a *Unit Price* adjusted pursuant to paragraph 6.7.1 shall not exceed the *Unit Price* that would cause the extended amount to equal the original extended amount derived from the original *Unit Price* and estimated quantity.

6.7.4 If either party requests adjustment of a *Unit Price*, both parties shall make all reasonable efforts to agree on a revised *Unit Price*. The agreed revised *Unit Price* shall be recorded in a Change Order.

6.7.5 If agreement on a revised *Unit Price* is not reached, the matter shall be subject to final determination in accordance with Part 8 - DISPUTE RESOLUTION. Pending determination of the revised *Unit Price*, payment for the *Work* performed shall be included in progress payments based on the unrevised *Unit Price*.

PART 7 DEFAULT NOTICE

GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, STOP THE WORK, OR TERMINATE THE CONTRACT

7.1.1 If the *Contractor* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Contractor*'s insolvency, or if a receiver is appointed because of the *Contractor*'s insolvency, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, by giving the *Contractor* or receiver or trustee in bankruptcy notice in writing, terminate the *Contract*.

7.1.2 If the *Contractor* neglects to prosecute the *Work* properly or otherwise fails to comply with the requirements of the *Contract* to a substantial degree and if the *Consultant* has given a written statement to the *Owner* and *Contractor* that sufficient cause exists to justify such action, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, notify the *Contractor* in writing that the *Contractor* is in default of the *Contractor*'s contractual obligations and instruct the *Contractor* to correct the default in the 5 *Working Days* immediately following the receipt of such notice.

7.1.3 If the default cannot be corrected in the 5 *Working Days* specified, the *Contractor* shall be in compliance with the *Owner*'s instructions if the *Contractor*:

.1 commences the correction of the default within the specified time, and

.2 provides the *Owner* with an acceptable schedule for such correction, and

.3 corrects the default in accordance with such schedule.

7.1.4 If the *Contractor* fails to correct the default in the time specified or subsequently agreed upon, without prejudice to any other right or remedy the *Owner* may have, the *Owner* may:

.1 correct such default and deduct the cost thereof from any payment then or thereafter due the *Contractor* provided the *Consultant* has certified such cost to the *Owner* and the *Contractor*, or

.2 terminate the *Contractor*'s right to continue with the *Work* in whole or in part or terminate the *Contract*.

7.1.5 If the *Owner* terminates the *Contractor*'s right to continue with the *Work* as provided in paragraphs 7.1.1 and 7.1.4, the *Owner* shall be entitled to:

.1 take possession of the *Work* and *Products* delivered to the *Place of the Work*, subject to the rights of third parties, and finish the *Work* by whatever method the *Owner* may consider expedient, but without undue delay or expense, and

.2 withhold further payment to the *Contractor* until a final certificate for payment is issued, and

.3 charge the *Contractor* the amount by which the full cost of finishing the *Work* as certified by the *Consultant*, including compensation to the *Consultant* for the *Consultant*'s additional services and a reasonable allowance as determined by the *Consultant* to cover the cost of corrections to work performed by the *Contractor* that may be required under GC 12.3 - WARRANTY, exceeds the unpaid balance of the *Contract Price*; however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference, and

.4 on expiry of the warranty period, charge the *Contractor* the amount by which the cost of corrections to the *Contractor*'s work under GC 12.3 - WARRANTY exceeds the allowance provided for such corrections, or if the cost of such corrections is less than the allowance, pay the *Contractor* the difference.

7.1.6 The *Contractor*'s obligation under the *Contract* as to quality, correction, and warranty of the work performed by the *Contractor* up to the time of termination shall continue in force after such termination.

GC 7.2 CONTRACTOR'S RIGHT TO STOP THE WORK OR TERMINATE THE CONTRACT

7.2.1 If the *Owner* is adjudged bankrupt, or makes a general assignment for the benefit of creditors because of the *Owner*'s insolvency, or if a receiver is appointed because of the *Owner*'s insolvency, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, by giving the *Owner* or receiver or trustee in bankruptcy notice in writing, terminate the *Contract*.

7.2.2 If the *Work* is stopped or otherwise delayed for a period of 20 *Working Days* or more under an order of a court or other public authority and providing that such order was not issued as the result of an act or fault of the *Contractor* or of anyone directly or indirectly employed or engaged by the *Contractor*, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, by giving the *Owner* notice in writing, terminate the *Contract*.

7.2.3 The *Contractor* may notify the *Owner* in writing, with a copy to the *Consultant*, that the *Owner* is in default of the *Owner*'s contractual obligations if:

.1 the *Owner* fails to furnish, when so requested by the *Contractor*, reasonable evidence that financial arrangements have been made to fulfill the *Owner*'s obligations under the *Contract*, or

.2 the *Consultant* fails to issue a certificate as provided in GC 5.3 PROGRESS PAYMENT, or

.3 the *Owner* fails to pay the *Contractor* when due the amounts certified by the *Consultant* or awarded by arbitration or court, or

.4 the *Owner* violates the requirements of the *Contract* to a substantial degree and the *Consultant*, except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER, confirms by written statement to the *Contractor* that sufficient cause exists.

7.2.4 The *Contractor*'s notice in writing to the *Owner* provided under paragraph 7.2.3 shall advise that if the default is not corrected within 5 *Working Days* following the receipt of the notice in writing, the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, stop the *Work* or terminate the *Contract*.

7.2.5 If the *Contractor* terminates the *Contract* under the conditions set out above, the *Contractor* shall be entitled to be paid for all work performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*.

PART 8 DISPUTE RESOLUTION

GC 8.1 AUTHORITY OF THE CONSULTANT

8.1.1 Differences between the parties to the *Contract* as to the interpretation, application or administration of the *Contract* or any failure to agree where agreement between the parties is called for, herein collectively called disputes, which are not resolved in the first instance by findings of the *Consultant* as provided in GC 2.2 - ROLE OF THE CONSULTANT, shall be settled in accordance with the requirements of Part 8 of the General Conditions - DISPUTE RESOLUTION.

8.1.2 If a dispute arises under the *Contract* in respect of a matter in which the *Consultant* has no authority under the *Contract* to make a finding, the procedures set out in paragraph 8.1.3 and paragraphs 8.2.3 to 8.2.8 of GC 8.2 - NEGOTIATION, MEDIATION, AND ARBITRATION, and in GC 8.3 - RETENTION OF RIGHTS apply to that dispute with the necessary changes to detail as may be required.

8.1.3 If a dispute is not resolved promptly, the *Consultant* will give such instructions as in the *Consultant*'s opinion are necessary for the proper performance of the *Work* and to prevent delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim the party may have. If it is subsequently determined that such instructions were in error or at variance with the *Contract Documents*, the *Owner* shall pay the *Contractor* costs incurred by the *Contractor* in carrying out such instructions which the *Contractor* was required to do beyond what the *Contract Documents* correctly understood and interpreted would have required, including costs resulting from interruption of the *Work*.

GC 8.2 NEGOTIATION, MEDIATION, AND ARBITRATION

8.2.1 In accordance with the latest edition of the Rules for Mediation of Construction Disputes as provided in CCDC 40, the parties shall appoint a Project Mediator

.1 within 20 *Working Days* after the *Contract* was awarded, or

.2 if the parties neglected to make an appointment within the 20 *Working Day* period, within 10 *Working Days* after either party by notice in writing requests that the Project Mediator be appointed.

8.2.2 A party shall be conclusively deemed to have accepted a finding of the *Consultant* under GC 2.2 - ROLE OF THE CONSULTANT and to have expressly waived and released the other party from any claims in respect of the particular matter dealt with in that finding unless, within 15 *Working Days* after receipt of that finding, the party sends a notice in writing of dispute to the other party and to the *Consultant*, which contains the particulars of the matter in dispute and the relevant provisions of the *Contract Documents*. The responding party shall send a notice in writing of reply to the dispute within 10 *Working Days* after receipt of the notice of dispute setting out particulars of this response and any relevant provisions of the *Contract Documents*.

8.2.3 The parties shall make all reasonable efforts to resolve their dispute by amicable negotiations and agree to provide, without prejudice, frank, candid and timely disclosure of relevant facts, information, and documents to facilitate these negotiations.

8.2.4 After a period of 10 *Working Days* following receipt of a responding party's notice in writing of reply under paragraph 8.2.2, the parties shall request the Project Mediator to assist the parties to reach agreement on any unresolved dispute. The mediated negotiations shall be conducted in accordance with the latest edition of the Rules for Mediation of Construction Disputes as provided in CCDC 40.

8.2.5 If the dispute has not been resolved within 10 *Working Days* after the Project Mediator was requested under paragraph 8.2.4 or within such further period agreed by the parties, the Project Mediator shall terminate the mediated negotiations by giving notice in writing to both parties.

8.2.6 By giving a notice in writing to the other party, not later than 10 *Working Days* after the date of termination of the mediated negotiations under paragraph 8.2.5, either party may refer the dispute to be finally resolved by arbitration under the latest edition of the Rules for Arbitration of Construction Disputes as provided in CCDC 40. The arbitration shall be conducted in the jurisdiction of the *Place of the Work*.

8.2.7 On expiration of the 10 *Working Days*, the arbitration agreement under paragraph 8.2.6 is not binding on the parties and, if a notice is not given under paragraph 8.2.6 within the required time, the parties may refer the unresolved dispute to the courts or to any other form of dispute resolution, including arbitration, which they have agreed to use.

8.2.8 If neither party requires by notice in writing given within 10 *Working Days* of the date of notice requesting arbitration in paragraph 8.2.6 that a dispute be arbitrated immediately, all disputes referred to arbitration as provided in paragraph 8.2.6 shall be

.1 held in abeyance until
(1) *Substantial Performance of the Work*,
(2) the *Contract* has been terminated, or
(3) the *Contractor* has abandoned the *Work*,
whichever is earlier, and

.2 consolidated into a single arbitration under the rules governing the arbitration under paragraph 8.2.6.

GC 8.3 RETENTION OF RIGHTS

8.3.1 It is agreed that no act by either party shall be construed as a renunciation or waiver of any rights or recourses, provided the party has given the notices required under Part 8 of the General Conditions - DISPUTE RESOLUTION and has carried out the instructions as provided in paragraph 8.1.3.

8.3.2 Nothing in Part 8 of the General Conditions - DISPUTE RESOLUTION shall be construed in any way to limit a party from asserting any statutory right to a lien under applicable lien legislation of the jurisdiction of the *Place of the Work* and the assertion of such right by initiating judicial proceedings is not to be construed as a waiver of any right that party may have under paragraph 8.2.6 to proceed by way of arbitration to adjudicate the merits of the claim upon which such a lien is based.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

9.1.1 The *Contractor* shall protect the *Work* and the *Owner*'s property and property adjacent to the *Place of the Work* from damage which may arise as the result of the *Contractor*'s operations under the *Contract*, and shall be responsible for such damage, except damage which occurs as the result of:

.1 errors in the *Contract Documents*;

.2 acts or omissions by the *Owner*, the *Consultant*, other contractors, their agents and employees.

9.1.2 Before commencing any work, the *Contractor* shall determine the location of all known underground utilities and structures indicated in the *Contract Documents* or that are reasonably apparent in an inspection of the *Place of the Work*.

9.1.3 Should the *Contractor* in the performance of the *Contract* damage the *Work*, the *Owner*'s property, or property adjacent to the *Place of the Work*, the *Contractor* shall be responsible for the making good such damage at the *Contractor*'s expense.

9.1.4 Should damage occur to the *Work* or *Owner*'s property for which the *Contractor* is not responsible, as provided in paragraph 9.1.1, the *Contractor* shall make good such damage to the *Work* and, if the *Owner* so directs, to the *Owner*'s property. The *Contract Price* and *Contract Time* shall be adjusted as provided in GC 6.1 - CHANGES, GC 6.2 - CHANGE ORDER, and GC 6.3 - CHANGE DIRECTIVE.

GC 9.2 DAMAGES AND MUTUAL RESPONSIBILITY

9.2.1 If either party to the *Contract* should suffer damage in any manner because of any wrongful act or neglect of the other party or of anyone for whom the other party is responsible in law, then that party shall be reimbursed by the other party for such damage. The reimbursing party shall be subrogated to the rights of the other party in respect of such wrongful act or neglect if it be that of a third party.

9.2.2 If the *Contractor* has caused damage to the work of another contractor on the *Project*, the *Contractor* shall upon due notice in writing settle with the other contractor by negotiation or arbitration. If the other contractor makes a claim against the *Owner* on account of damage alleged to have been so sustained, the *Owner* shall notify the *Contractor* in writing and may require the *Contractor* to defend the action at the *Contractor*'s expense. The *Contractor* shall satisfy a final order or judgment against the *Owner* and pay the costs incurred by the *Owner* arising from such action.

9.2.3 If the *Contractor* becomes liable to pay or satisfy a final order, judgment, or award against the *Owner*, then the *Contractor*, upon undertaking to indemnify the *Owner* against any and all liability for costs, shall have the right to appeal in the name of the *Owner* such final order or judgment to any and all courts of competent jurisdiction.

GC 9.3 TOXIC AND HAZARDOUS SUBSTANCES

9.3.1 For the purposes of applicable environmental legislation, the *Owner* shall be deemed to have control and management of the *Place of the Work* with respect to existing conditions.

9.3.2 Prior to the *Contractor* commencing the *Work*, the *Owner* shall:

.1 take all reasonable steps to determine whether any toxic or hazardous substances are present at the *Place of the Work*, and

.2 provide the *Consultant* and the *Contractor* with a written list of any such substances that are known to exist and their locations.

9.3.3 The *Owner* shall take all reasonable steps to ensure that no person suffers injury, sickness, or death and that no property is damaged or destroyed as a result of exposure to, or the presence of, toxic or hazardous substances which were at the *Place of the Work* prior to the *Contractor* commencing the *Work*.

9.3.4 Unless the *Contract* expressly provides otherwise, the *Owner* shall be responsible for taking all necessary steps, in accordance with legal requirements, to dispose of, store or otherwise render harmless toxic or hazardous substances which were present at the *Place of the Work* prior to the *Contractor* commencing the *Work*.

9.3.5 If the *Contractor*

.1 encounters toxic or hazardous substances at the *Place of the Work*, or

.2 has reasonable grounds to believe that toxic or hazardous substances are present at the *Place of the Work*,

which were not disclosed by the *Owner*, as required under paragraph 9.3.2, or which were disclosed but have not been dealt with as required under paragraph 9.3.4, the *Contractor* shall

.3 take all reasonable steps, including stopping the *Work*, to ensure that no person suffers injury, sickness, or death and that no property is damaged or destroyed as a result of exposure to or the presence of the substances, and

.4 immediately report the circumstances to the *Consultant* and the *Owner* in writing.

9.3.6 If the *Contractor* is delayed in performing the *Work* or incurs additional costs as a result of taking steps required under paragraph 9.3.5.3, the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor* and the *Contractor* shall be reimbursed for reasonable costs incurred as a result of the delay and as a result of taking those steps.

9.3.7 Notwithstanding paragraphs 2.2.6 and 2.2.7 of GC 2.2 - ROLE OF THE CONSULTANT, or paragraph 8.1.1 of GC 8.1 - AUTHORITY OF THE CONSULTANT, the *Consultant* may select and rely upon the advice of an independent expert in a dispute under paragraph 9.3.6 and, in that case, the expert shall be deemed to have been jointly retained by the *Owner* and the *Contractor* and shall be jointly paid by them.

9.3.8 The *Owner* shall indemnify and hold harmless the *Contractor*, the *Consultant*, their agents and employees, from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of or resulting from exposure to, or the presence of, toxic or hazardous substances which were at the *Place of the Work* prior to the *Contractor* commencing the *Work*. This obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity set out in GC 12.1 - INDEMNIFICATION or which otherwise exist respecting a person or party described in this paragraph.

9.3.9 GC 9.3 - TOXIC AND HAZARDOUS SUBSTANCES shall govern over the provisions of paragraph 1.3.1 of GC 1.3 RIGHTS AND REMEDIES or GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY.

GC 9.4 ARTIFACTS AND FOSSILS

9.4.1 Fossils, coins, articles of value or antiquity, structures, and other remains or things of scientific or historic interest discovered at the *Place or Work* shall, as between the *Owner* and the *Contractor*, be deemed to be the absolute property of the *Owner*.

9.4.2 The *Contractor* shall take all reasonable precautions to prevent removal or damage to discoveries as identified in paragraph 9.4.1, and shall notify the *Consultant* immediately upon discovery of such items.

9.4.3 The *Consultant* will investigate the impact on the *Work* of the discoveries identified in paragraph 9.4.1. If conditions are found that would cause an increase or decrease in the *Contractor*'s cost or time to perform the *Work*, the *Consultant*, with the *Owner's* approval, shall issue appropriate instructions for a change in the *Work* as provided in GC 6.2 - CHANGE ORDER or GC 6.3 - CHANGE DIRECTIVE.

GC 9.5 CONSTRUCTION SAFETY

9.5.1 Subject to paragraph 3.2.2.2 of GC 3.2 - CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, the *Contractor* shall be solely responsible for construction safety at the *Place or the Work* and for compliance with the rules, regulations, and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the *Work*.

PART 10 GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

10.1.1 The *Contract Price* shall include all taxes and customs duties in effect at the time of the bid closing except for *Value Added Taxes* payable by the *Owner* to the *Contractor* as stipulated in Article A-4 of the Agreement - CONTRACT PRICE.

10.1.2 Any increase or decrease in costs to the *Contractor* due to changes in such included taxes and duties after the time of bid closing shall increase or decrease the *Contract Price* accordingly.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

10.2.1 The laws of the *Place of the Work* shall govern the *Work*.

10.2.2 Except for the permits and fees, including those required under paragraph 10.2.3, which the *Contract Documents* specify as the responsibility of the *Contractor*, the *Owner* shall obtain and pay for all necessary approvals, permits, permanent easements, and rights of servitude.

10.2.3 The *Contractor* shall obtain and pay for permits, licenses, inspections and certificates necessary for performance of the *Work* and customarily obtained after signing of the *Contract*.

10.2.4 The *Contractor* shall give the required notices and comply with the laws, ordinances, rules, regulations, or codes which are or become in force during the performance of the *Work* and which relate to the *Work*, to the preservation of the public health, and to construction safety.

10.2.5 The *Contractor* shall not be responsible for verifying that the *Contract Documents* are in compliance with the applicable laws, ordinances, rules, regulations, or codes relating to the *Work*. If the *Contract Documents* are at variance therewith, or if, subsequent to the time of bid closing, changes are made to the applicable laws, ordinances, rules, regulations, or codes which require modification to the *Contract Documents*, the *Contractor* shall notify the *Consultant* in writing requesting direction immediately upon such variance or change becoming known. The *Consultant* will make the changes required to the *Contract Documents* as provided in GC 6.1 - CHANGES, GC 6.2 - CHANGE ORDER, and GC 6.3 - CHANGE DIRECTIVE.

10.2.6 If the *Contractor* fails to notify the *Consultant* in writing; and fails to obtain direction as required in paragraph 10.2.5; and performs work knowing it to be contrary to any laws, ordinances, rules, regulations, or codes; the *Contractor* shall be responsible for and shall correct the violations thereof; and shall bear the costs, expenses, and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations, or codes.

10.2.7 If, subsequent to the time of bid closing, changes are made to applicable laws, ordinances, rules, regulations, or codes of authorities having jurisdiction which affect the cost of the *Work*, either party may submit a claim in accordance with the requirements of GC 6.6 - CLAIMS.

GC 10.3 PATENT FEES

10.3.1 The *Contractor* shall pay the royalties and patent licence fees required for the performance of the *Contract*. The *Contractor* shall hold the *Owner* harmless from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention by the *Contractor* or anyone for whose acts the *Contractor* may be liable.

10.3.2 The *Owner* shall hold the *Contractor* harmless against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to an infringement or an alleged infringement of a patent of invention in executing anything for the purpose of the *Contract*, the model, plan, or design of which was supplied to the *Contractor* as part of the *Contract Documents*.

GC 10.4 WORKERS' COMPENSATION

10.4.1 Prior to commencing the *Work*, *Substantial Performance of the Work*, and the issuance of the final certificate for payment, the *Contractor* shall provide evidence of compliance with workers' compensation legislation at the *Place of the Work*, including payments due thereunder.

10.4.2 At any time during the term of the *Contract*, when requested by the *Owner*, the *Contractor* shall provide such evidence of compliance by the *Contractor* and *Subcontractors*.

PART 11 INSURANCE AND CONTRACT SECURITY

GC 11.1 INSURANCE

11.1.1 Without restricting the generality of GC 12.1 - INDEMNIFICATION, the *Contractor* shall provide, maintain, and pay for the insurance coverages specified in GC 11.1 - INSURANCE. Unless otherwise stipulated, the duration of each insurance policy shall be from the date of commencement of the *Work* until the date of the final certificate for payment. Prior to commencement of the *Work* and upon the placement, renewal, amendment, or extension of all or any part of the insurance, the *Contractor* shall promptly provide the *Owner* with confirmation of coverage and, if required, a certified true copy of the policies certified by an authorized representative of the insurer together with copies of any amending endorsements.

.1 General Liability Insurance:
General liability insurance shall be in the joint names of the *Contractor*, the *Owner*, and the *Consultant*, with limits of not less than $2,000,000 per occurrence and with a property damage deductible not exceeding $2,500. The insurance coverage shall not be less than the insurance required by IBC Form 2100, or its equivalent replacement, provided that IBC Form 2100 shall contain the latest edition of the relevant CCDC endorsement form. To achieve the desired limit, umbrella, or excess liability insurance may be used. All liability coverage shall be maintained for completed operations hazards from the date of *Substantial Performance of the Work*, as set out in the certificate of *Substantial Performance of the Work*, on an ongoing basis for a period of 6 years following *Substantial Performance of the Work*. Where the *Contractor* maintains a single, blanket policy, the addition of the *Owner* and the *Consultant* is limited to liability arising out of the *Work* and all operations necessary or incidental thereto. The policy shall be endorsed to provide the *Owner* with not less than 30 days notice in writing in advance of any cancellation, and of change or amendment restricting coverage.

.2 Automobile Liability Insurance:
Automobile liability insurance in respect of licensed vehicles shall have limits of not less than $2,000,000 inclusive per occurrence for bodily injury, death, and damage to property, covering all licensed vehicles owned or leased by the *Contractor*, and endorsed to provide the *Owner* with not less than 15 days notice in writing in advance of any cancellation, change or amendment restricting coverage. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.

.3 Aircraft and Watercraft Liability Insurance:
Aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft if used directly or indirectly in the performance of the *Work*, including use of additional premises, shall be subject to limits of not less than $2,000,000 inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof and limits of not less than $2,000,000 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 15 days notice in writing in advance of cancellation, change, or amendment restricting coverage.

.4 Property and Boiler and Machinery Insurance:
(1) "All risks" property insurance shall be in the joint names of the *Contractor*, the *Owner*, the *Consultant*, and all *Subcontractors*, insuring not less than the sum of the amount of the *Contract Price* and the full value, as stated in the Supplementary Conditions, of *Products* that are specified to be provided by the *Owner* for incorporation into the *Work*, with a deductible not exceeding $2,500. The insurance coverage shall not be less than the insurance required by IBC Form 4042 or its equivalent replacement, provided that IBC Form 4042 shall contain the latest edition of the relevant CCDC endorsement form. The coverage shall be maintained continuously until 5 *Working Days* after the date of the final certificate for payment.
(2) Boiler and machinery insurance shall be in the joint names of the *Contractor*, the *Owner*, and the *Consultant* for not less than the replacement value of the boilers, pressure vessels, and other insurable objects forming part of the *Work*. The insurance provided shall not be less than the insurance provided by the "Comprehensive Boiler and Machinery Form" and shall be maintained continuously from commencement of use or operation of the property insured and until 5 *Working Days* after the date of the final certificate for payment.

(3) The policies shall allow for partial or total use or occupancy of the *Work*. If because of such use or occupancy the *Contractor* is unable to provide coverage, the *Contractor* shall notify the *Owner* in writing. Prior to such use or occupancy the *Owner* shall provide, maintain, and pay for all risk property and boiler insurance insuring the full value of the *Work*, as in sub-paragraphs (1) and (2), including coverage for such use or occupancy and shall provide the *Contractor* with proof of such insurance. The *Contractor* shall refund to the *Owner* the unearned premiums applicable to the *Contractor*'s policies upon termination of coverage.

(4) The policies shall provide that, in the case of a loss or damage, payment shall be made to the *Owner* and the *Contractor* as their respective interests may appear. The *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to such reasonable extension of *Contract Time* relative to the extent of the loss or damage as the *Consultant* may recommend in consultation with the *Contractor*.

(5) The *Contractor* shall be entitled to receive from the *Owner*, in addition to the amount due under the *Contract*, the amount at which the *Owner*'s interest in restoration of the *Work* has been appraised, such amount to be paid as the restoration of the *Work* proceeds and as provided in GC 5.5 - APPLICATIONS FOR PROGRESS PAYMENT and GC 5.6 - PROGRESS PAYMENT. In addition the *Contractor* shall be entitled to receive from the payments made by the insurer the amount of the *Contractor*'s interest in the restoration of the *Work*.

(6) In the case of loss or damage to the *Work* arising from the work of another contractor, or *Owner*'s own forces, the *Owner*, in accordance with the *Owner*'s obligations under paragraph 3.2.2.4 of GC 3.2 - CONSTRUCTION BY OWNER OR OTHER CONTRACTORS, shall pay the *Contractor* the cost of restoring the *Work* as the restoration of the *Work* proceeds and as provided in GC 5.5 - APPLICATIONS FOR PROGRESS PAYMENT and GC 5.6 - PROGRESS PAYMENT.

.5 Contractors' Equipment Insurance:
"All risks" contractors' equipment insurance covering *Construction Equipment* used by the *Contractor* for the performance of the *Work*, including boiler insurance on temporary boilers and pressure vessels, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. The policies shall be endorsed to provide the *Owner* with not less than 15 days notice in writing in advance of cancellation, change, or amendment restricting coverage. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance, the *Owner* agrees to waive the equipment insurance requirement.

11.1.2 The *Contractor* shall be responsible for deductible amounts under the policies except where such amounts may be excluded from the *Contractor*'s responsibility by the terms of GC 9.1 - PROTECTION OF WORK AND PROPERTY and GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY.

11.1.3 Where the full insurable value of the *Work* is substantially less than the *Contract Price*, the *Owner* may reduce the amount of insurance required or waive the course of construction insurance requirement.

11.1.4 If the *Contractor* fails to provide or maintain insurance as required by the *Contract Documents*, then the *Owner* shall have the right to provide and maintain such insurance and give evidence to the *Contractor* and the *Consultant*. The *Contractor* shall pay the cost thereof to the *Owner* on demand or the *Owner* may deduct the amount which is due or may become due to the *Contractor*.

11.1.5 All required insurance policies shall be with insurers licensed to underwrite insurance in the jurisdiction of the *Place of the Work*.

GC 11.2 CONTRACT SECURITY

11.2.1 The *Contractor* shall, prior to commencement of the *Work* or within the specified time, provide to the *Owner* any contract security specified in the *Contract Documents*.

11.2.2 If the *Contract Documents* require surety bonds to be provided, such bonds shall be issued by a duly licensed surety company authorized to transact the business of suretyship in the province or territory of the *Place of the Work* and shall be maintained in good standing until the fulfillment of the *Contract*. The form of such bonds shall be in accordance with the latest edition of the CCDC approved bond forms.

PART 12 INDEMNIFICATION — WAIVER — WARRANTY

GC 12.1 INDEMNIFICATION

12.1.1 The *Contractor* shall indemnify and hold harmless the *Owner* and the *Consultant*, their agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings (hereinafter called "claims"), by third parties that arise out of, or are attributable to, the *Contractor*'s performance of the *Contract* provided such claims are:

.1 attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, and

.2 caused by negligent acts or omissions of the *Contractor* or anyone for whose acts the *Contractor* may be liable, and

.3 made in writing within a period of 6 years from the date of *Substantial Performance of the Work* as set out in the certificate of *Substantial Performance of the Work*, or within such shorter period as may be prescribed by any limitation statute of the province or territory of the *Place of the Work*.

The *Owner* expressly waives the right to indemnity for claims other than those stated above.

12.1.2 The obligation of the *Contractor* to indemnify hereunder shall be limited to $2,000,000 per occurrence from the commencement of the *Work* until *Substantial Performance of the Work* and thereafter to an aggregate limit of $2,000,000.

12.1.3 The *Owner* shall indemnify and hold harmless the *Contractor*, the *Contractor*'s agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor*'s performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of the Work*.

12.1.4 GC 12.1 - INDEMNIFICATION shall govern over the provisions of paragraph 1.3.1 of GC 1.3 -RIGHTS AND REMEDIES or GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY.

GC 12.2 WAIVER OF CLAIMS

12.2.1 Waiver of Claims by *Owner*

As of the date of the final certificate for payment, the *Owner* expressly waives and releases the *Contractor* from all claims against the *Contractor* including without limitation those that might arise from the negligence or breach of contract by the *Contractor* except one or more of the following:

.1 those made in writing prior to the date of the final certificate for payment and still unsettled;

.2 those arising from the provisions of GC 12.1 - INDEMNIFICATION or GC 12.3 - WARRANTY;

.3 those arising from the provisions of paragraph 9.3.5 of GC 9.3 - TOXIC AND HAZARDOUS SUBSTANCES AND MATERIALS and arising from the *Contractor* bringing or introducing any toxic or hazardous substances and materials to the *Place of the Work* after the *Contractor* commences the *Work*.

In the Common Law provinces GC 12.2.1.4 shall read as follows:

.4 those made in writing within a period of 6 years from the date of *Substantial Performance of the Work*, as set out in the certificate of *Substantial Performance of the Work*, or within such shorter period as may be prescribed by any limitation statute of the province or territory of the *Place of the Work* and arising from any liability of the *Contractor* for damages resulting from the *Contractor*'s performance of the *Contract* with respect to substantial defects or deficiencies in the *Work* for which the *Contractor* is proven responsible. As used herein "substantial defects or deficiencies" means those defects or deficiencies in the *Work* which affect the *Work* to such an extent or in such a manner that a significant part or the whole of the *Work* is unfit for the purpose intended by the *Contract Documents*.

In the Province of Quebec GC 12.2.1.4 shall read as follows:

.4 those arising under the provisions of Article 2118 of the Civil Code of Quebec.

12.2.2 Waiver of Claims by *Contractor*

As of the date of the final certificate for payment, the *Contractor* expressly waives and releases the *Owner* from all claims against the *Owner* including without limitation those that might arise from the negligence or breach of contract by the *Owner* except:

.1 those made in writing prior to the *Contractor*'s application for final payment and still unsettled; and

.2 those arising from the provisions of GC 9.3 - TOXIC AND HAZARDOUS SUBSTANCES or GC 10.3 - PATENT FEES.

12.2.3 GC 12.2 - WAIVER OF CLAIMS shall govern over the provisions of paragraph 1.3.1 of GC 1.3 - RIGHTS AND REMEDIES, GC 6.6 - CLAIMS, and GC 9.2 - DAMAGES AND MUTUAL RESPONSIBILITY.

GC 12.3 WARRANTY

12.3.1 Except for extended warranties as described in paragraph 12.3.6, the warranty period under the *Contract* is one year from the date of *Substantial Performance of the Work.*

12.3.2 The *Contractor* shall be responsible for the proper performance of the *Work* to the extent that the design and *Contract Documents* permit such performance.

12.3.3 Subject to paragraph 12.3.2, the *Contractor* shall correct promptly, at the *Contractor*'s expense, defects or deficiencies in the *Work* which appear prior to and during the warranty periods specified in the *Contract Documents.*

12.3.4 The *Owner*, through the *Consultant*, shall promptly give the *Contractor* notice in writing of observed defects and deficiencies which occur during the one-year warranty period.

12.3.5 The *Contractor* shall correct or pay for damage resulting from corrections made under the requirements of paragraph 12.3.3.

12.3.6 Any extended warranties required beyond the one-year warranty period, as described in paragraph 12.3.1, shall be as specified in the *Contract Documents*. Extended warranties shall be issued by the warrantor to the benefit of the *Owner*. The *Contractor's* responsibility with respect to extended warranties shall be limited to obtaining any such extended warranties from the warrantor. The obligations under such extended warranties are solely the responsibility of the warrantor.

INSURANCE REQUIREMENTS

END OF SECTION

1900-275 Slater Street
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CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE
CANADIAN CONSTRUCTION DOCUMENTS COMMITTEE

CCDC 41
CCDC INSURANCE REQUIREMENTS

PUBLICATION DATE: December 14, 2020

1. General liability insurance shall be with limits of not less than $10,000,000 per occurrence, an aggregate limit of not less than $10,000,000 within any policy year with respect to completed operations, and a deductible not exceeding $10,000. The insurance coverage shall not be less than the insurance provided by IBC Form 2100 (including an extension for a standard provincial and territorial form of non-owned automobile liability policy) and IBC Form 2320. To achieve the desired limit, umbrella or excess liability insurance may be used. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.

2. Automobile liability insurance in respect of vehicles that are required by law to be insured under a contract by a Motor Vehicle Liability Policy, shall have limits of not less than $10,000,000 inclusive per occurrence for bodily injury, death and damage to property, covering all vehicles owned or leased by the *Contractor*. Where the policy has been issued pursuant to a government-operated automobile insurance system, the *Contractor* shall provide the *Owner* with confirmation of automobile insurance coverage for all automobiles registered in the name of the *Contractor*.

3. Manned Aircraft and watercraft liability insurance with respect to owned or non-owned aircraft and watercraft (if used directly or indirectly in the performance of the *Work*), including use of additional premises, shall have limits of not less than $10,000,000 inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof and limits of not less than $10,000,000 for aircraft passenger hazard. Such insurance shall be in a form acceptable to the *Owner*.

4. Unmanned aerial vehicle liability insurance with respect to owned or non-owned aircraft (if used directly or indirectly in the performance of the Work), shall have limits of not less than $5,000,000 per occurrence or accident for bodily injury, death and damage to property or such amounts as required by any applicable law or regulation.

5. "Broad form" property insurance shall have limits of not less than the sum of 1.1 times *Contract Price* and the full value, as stated in the *Contract*, of *Products* and design services that are specified to be provided by the *Owner* for incorporation into the *Work*, with a deductible not exceeding $10,000. The insurance coverage shall not be less than the insurance provided by IBC Forms 4042 and 4047 or their equivalent replacement. Subject to satisfactory proof of financial capability by the *Contractor*, the *Owner* may agree to increase the deductible amounts.

6. Boiler and machinery insurance shall have limits of not less than the replacement value of the permanent or temporary boilers and pressure vessels, and other insurable objects forming part of the *Work*. The insurance coverage shall not be less than the insurance provided by a comprehensive boiler and machinery policy including hot testing and commissioning.

7. Contractors' equipment insurance coverage written on an “all risks” basis covering *Construction Equipment* used by the *Contractor* for the performance of the *Work*, shall be in a form acceptable to the *Owner* and shall not allow subrogation claims by the insurer against the *Owner*. Subject to satisfactory proof of financial capability by the *Contractor* for self-insurance, the *Owner* may agree to waive the equipment insurance requirement.

8. Contractors’ Pollution liability insurance shall have limits of not less than $5,000,000 per occurrence for bodily injury, death and damage to property.

Association of Canadian Engineering Companies

Canadian Construction Association

Construction Specifications Canada

The Royal Architectural Institute of Canada

THESE SUPPLEMENTARY GENERAL CONDITIONS AMEND THE DEFINITIONS AND GENERAL CONDITIONS

DEFINITIONS

1. Page 6, delete Definition 7 and replace with the following new definition:

   7. The Contract Price shall be the sum of the products of the actual final quantities that are incorporated in, or made necessary by the Work, as confirmed by count and measurement, multiplied by the appropriate Unit Prices from the Tender Form together with any adjustments that are made in accordance with the provisions of the Contract Documents plus the amount of Government Sales Tax. When a Lump Sum Stipulated Price form the basis of payment, the Contract Price is as stated in the Form of Agreement, Article A-4, plus the amount of Government Sales Tax.

GENERAL CONDITIONS OF CONTRACT

1. GC 2.4 – DEFECTIVE WORK

Page 11, clause 2.4.3, add the following sentence at the end of the clause:

"If the Consultant determination is not accepted by either party, then the matter shall be settled in accordance with the requirements of Part 8 of the General Conditions – DISPUTE RESOLUTION."

2. GC 3.7 – LAYOUT OF THE WORK

Page 13, delete clause 3.7.1 in its entirety and replace with the following:

3.7.1 Before the work of the Contract begins, the Consultant will, once only, provide the data for sufficient reference points to identify the Works on the ground. The Contractor shall have all reference points established on site by a licensed surveyor, at the place of the Work, at no additional cost to the Owner.

3. GC 3.11 – SHOP DRAWINGS

Page 14, clause 3.11.4, delete second sentence and replace to read: "Contractor shall prepare and jointly review with Consultant a schedule of dates for submission of shop drawings."

4. GC 5.4 – BASIS OF PAYMENT FOR COST PLUS WORK

Page 16, after clause 5.4.2, add the following:

5.4.3 The percentage fee as stated in clause 5.4.1 shall be two percent (2%) of the cost plus work but shall not be applied to

the cost of construction equipment when such cost is based on rates which already include overhead and profit.

5. GC 5.6 – PROGRESS PAYMENT

Page 18, in clause 5.6.1, line 1, change "5 working days" to read "10 calendar days" and in line 2, change "GC5.2" to read "GC 5.5".

Page 18, delete clause 5.6.2 in its entirety and replace with the following:

5.6.2 The Owner shall make payment to the Contractor on account as provided in Article A-5 of the Agreement – PAYMENT on or before twenty (20) calendar days after the later of:
.1 receipt by the Consultant of the application for payment; or
.2 the last day of the monthly payment period covered by the application for payment.

Page 18, after clause 5.6.3, add the following additional clause:

5.6.4 The Contractor shall pay promptly any and all accounts for labour, services and materials used for the purpose of the fulfillment of this Contract as and when such accounts become due and payable and shall furnish the Consultant with proof of payment of such accounts in such form and as often as the Consultant may request.

6. GC 5.7 – SUBSTANTIAL PERFORMANCE OF THE WORK

Page 18, after clause 5.7.4, add the following additional clause:

5.7.5 Fifteen (15) days before the Contractor submits the application for Substantial Performance of the Work, all Operations and Maintenance Manual materials shall be submitted to the Consultant in accordance with the Contract Documents. The Certificate of Substantial Performance will not be issued until the Consultant received the required documents.

7. GC 5.8 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

Page 18, after clause 5.8.1.2, add the following:

5.8.1.3 Submit a certificate by deed search to the Owner by a solicitor qualified to practice law in the Province of Prince of Prince Edward Island that no lien associated with the Work exists against the Owner's property or work.

5.8.1.4 Submit a clearance letter from the Workers' Compensation Board.

5.8.1.5 All such documents shall be dated not earlier than the expiry of the lien period.

Page 19, delete clause 5.8.3 in its entirety, renumber subsequent clause.
Page 19, add new clause 5.8.4 as follows:

5.8.4 If, within 60 days after the issue by the Consultant of the Certificate of Substantial Performance, the Contractor has not corrected all the deficiencies, the Owner shall retain sufficient money to cover the cost of completing said deficiencies, as determined by the Consultant, in addition to holding monies retained in accordance with the provisions of this Contract and subject to the provisions of the Mechanics' Lien legislation of P.E.I.

8. GC 5.10 – FINAL PAYMENT

Page 19, delete clause 5.10.1 in its entirety and replace with the following:

5.10.1 When the Contractor considers that the Work is completed, the Contractor shall submit an application for final payment. The Contractor's application for final payment is considered to be valid when:

.1 Work has been completed in compliance with the Contract Documents and the Consultant is satisfied that all the requirements of the Contract have been fulfilled by the Contractor.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and balanced and are fully operational and written reports as outlined in the Contract Documents have been provided to the Consultant.

.4 Certificates required by utility companies, manufacturer's representative and inspectors have been submitted.

.5 Spare parts, maintenance materials, warranties and bonds have been provided.

5.10.2 If Work is deemed incomplete by the Consultant, complete outstanding items and request re-inspection.

5.10.3 If, in the opinion of the Consultant, it is not expedient to correct defective work or work is not performed in accordance with the requirements of the Contract, the Owner may deduct from the Contract Price the difference in value between work performed and that called for by the Contract Documents, the amount of which shall be determined by the Consultant.

Page 19, renumber existing clauses 5.10.2, 5.10.3 and 5.10.4 to 5.10.4, 5.10.5, and 5.10.6 respectively. In renumbered clause 5.10.6, change "5 working days" to read "20 calendar days".

9. GC 6.2 – CHANGE ORDER

Page 20, add new clause 6.2.4 as follows:

6.2.4 If the method of adjustment of the Contract Price presented by the Contractor is a lump sum or a unit price quotation as indicated in 6.2.2.2, the mark-up on changes shall be as follow:

.1 Work performed by Contractor's own forces: cost plus ten percent (10%) overhead plus ten percent (10%) fee.

.2 Work performed by Subcontractor's forces: cost plus ten percent (10%) overhead plus five percent (5%) fee.

10. GC 6.3 – CHANGE DIRECTIVE

Page 20, in clause 6.3.8, add the following sentence at the end of the paragraph:

"If such determination by the Consultant is not accepted by either party, then the decision shall be made in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION."

11. GC 6.5 – DELAYS

Page 21, clause 6.5.2, delete last sentence of paragraph and replace with the following sentence:

"The Contractor will not be reimbursed by the Owner for costs incurred by the Contractor as a result of such delay."

12. GC 9.5 – CONSTRUCTION SAFETY

Page 27, after GC 9.5.1, add the following:

9.5.2 W.H.M.I.S. – Workplace Hazardous Materials Information Systems & Hazardous Products Act – Government of Canada

Regulations under the Hazardous Products Act and the regulation regarding the handling and storage of hazardous materials must be complied with (reference: Regulation 88-221). These regulations stipulate that employees must be trained in the proper handling of workplace hazardous material.

13. GC 10.1 – TAXES AND DUTIES

Page 28, after clause 10.1.2, add the following:

10.1.3 The Contractor shall indicate on each application for payment, as a separate amount, the appropriate Government Sales Tax that 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.

14. GC 10.2 – LAWS, NOTICES, PERMITS AND FEES

Page 28, in paragraph 10.2.3, add new sentences to end of paragraph as follows:

"Various jurisdictions have requirements for posting non-refundable fees before excavations are carried out within public rights-of-way. The Contractor is responsible for the determination of the requirement for each specific project and for any required deposits."

15. **GC 11.1 - INSURANCE**

Insurance requirements shall meet CCDC 41 Insurance Requirements.

Page 29, GC 11.11.1.1, add the following sentence:

"Such insurance shall have Province of Prince Edward Island, Town of Stratford, Stratford Utility Corporation and the Consultant as additional insureds and shall contain cross liability coverage and preclude subrogation by the insured against the Owner".

16. GC 11.2 - CONTRACT SECURITY

Page 30, delete GC 11.2.1 in its entirety and replace with the following:

11.2.1 The Contractor shall, prior to commencement of the Work, provide to the Owner a Performance Bond and a Labour and Materials Bond, each in the amount of 50% of the Estimated Amount Due. Should it become apparent that the final cost of the project will exceed the Estimated Amount Due by more than 10%, the Contractor shall arrange to have his bonds reissued, based on the projected final cost.

Page 30, add new clause GC 11.2.2 as follows:

11.2.2 As an alternate to Performance and Labour and Material Payment Bonds, the contractor may provide security in the form of certified cheque in the amount of 10% of the tender price.

Page 31, add new clause GC 11.2.3 as follows:

11.2.3 The Contract Security will be retained until the expiration of the Period of Maintenance.

17. GC 12.3 – WARRANTY

Page 32, add new clause GC 12.3.7 as follows:

12.3.7 All work of repair or replacement carried out during the Warranty Period, shall be maintained for a period of one (1) year from the date of the Consultant's acceptance of the work of repair or replacement notwithstanding that the Warranty Period expires before the expiration of the said year. This clause shall not apply to normal operation maintenance, which shall be carried out by the Owner.

18. GC 13.1 TIME FOR COMPLETION

13.1.1 The Works shall be completed by the date indicated in the Article A-1 of the Agreement Between Owner and Contractor. The Date for Completion shall be the time to complete the Work given in the Tender Form.

19. GC 14.1 LIQUIDATED DAMAGES

14.1.1 Time shall be construed as being of the essence of the Contract.

14.1.2 Should the Contractor fail to complete the works by the Date for Completion, the period of time from the Date for Completion to the Date of Substantial Performance of the Works as determined by the Consultant, shall be termed the Period of Delay.

14.1.3 In the event of there being a Period of Delay, the Contractor shall be liable for and shall pay to the Owner the cost of continuance of supervision during the Period of Delay, and all additional fees, disbursements and costs incurred by the Owner by reason of there being such period of delay for each and every day that the work or works shall remain unfinished after the time so specified. The said sum or sums in view of the difficulty of ascertaining the losses which the Owner may suffer by reason of delay in the performance of the said Works, is hereby agreed upon, fixed and determined by the parties hereto as liquidated damages that the Owner will suffer by reason of said delay and default and not as penalty. The Owner may deduct the amount of such liquidated damages from each progress payment following the event until the project reaches Substantial Performance as certified by the Consultant.

END OF SECTION

1.1 DESCRIPTION OF WORK

.1 The work to be done and list of contract drawings are set forth in 00 21 10 - Description of Work and List of Drawings.

1.2 FAMILIARIZATION WITH SITE

.1 Before submitting a bid, it is recommended that bidders visit the site to review and verify the form, nature and extent of the work, materials needed, the means of access and the temporary facilities required to perform the Work.

1.3 CODES AND STANDARDS

.1 Perform work in accordance with the National Building Code (NBC) 2015, National Fire Code (NFC) 2015, National Plumbing Code (NPC) 2015 and any other code of provincial or local application, including all amendments up to bid closing date, provided that in any case of conflict or discrepancy, the more stringent requirement shall apply.

.2 Materials and workmanship must meet or exceed requirements of specified standards, codes and referenced documents.

1.4 INTERPRETATION OF DOCUMENTS

.1 Supplementary to the Order of Precedence article of the General Conditions of the Contract, the Division 01 sections take precedence over the technical specification sections in other Divisions of the Specification Manual.

1.5 TERM ENGINEER OR OWNER'S REPRESENTATIVE

.1 Unless specifically stated otherwise, the term Engineer or Owner's Representative where used in the Specifications and on the Drawings shall mean the Consultant as defined in the General Conditions of the Contract.

1.6 SETTING OUT WORK

.1 The Contractor will set stakes to define location, alignment and elevations of work, and measurement of the work.

.2 Supply such devices as straight edges and

templates required to facilitate Owner's Representatives inspection of work.

.3 Supply stakes and other survey markers required for laying out work.

1.7 MEASUREMENT FOR PAYMENT

.1 Notify Owner's Representative sufficiently in advance of operations to permit required measurements for payment.

1.8 MAINTENANCE OF WORK DURING CONSTRUCTION

.1 Maintain work during construction. Undertake continuous and effective maintenance work day by day, with adequate equipment and forces so that the roadway or structures are continuously kept in a condition satisfactory to Owner's Representative.

1.9 CODES

.1 Perform work in accordance with Code of Practice of the Department of Labour as it pertains to the Temporary Workplace Traffic Control Manual (Department of Transportation and Infrastructure) and any other code of federal, provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Materials and workmanship must conform to or exceed applicable standards of Canadian General Standards Board (CGSB), Canadian Standards Association (CSA), American Society for Testing and Materials (ASTM) and other standards organizations.

.3 Conform to latest revision of any referenced standard as re-affirmed or revised to date of specification. Standards or codes not dated shall be deemed editions in force on date of tender advertisement.

1.10 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each of following:

.1 Contract drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed drawings.
.5 Change orders.
.6 Other modifications to Contract.
.7 Copy of approved work schedule.

1.11 SITE CONDITIONS

.1 The Contractor will be responsible to visit the site and review existing site conditions.

1.12 CONSULTANT

.1 Consultant can be contacted at:

CBCL Limited
135 St. Peters Road, Suite 201
Charlottetown, PEI C1A 5P3
Telephone: (902)892-0303
Facsimile: (902)368-3444

1.13 WORK SCHEDULE

.1 Provide to the Owner's Representative in writing and within 5 working days after Contract award, a detailed construction schedule and traffic control plan. The schedule shall show proposed work to be undertaken and anticipated completion dates for each category of work in the Unit Price Table.

.2 After receiving the Contractor's plan and prior to start of construction, a pre-construction meeting involving Contractor and Owner's Representative will be held at a place and time to be determined by the Owner's Representative. This meeting will review implications of the contract, design, schedule of work, methods of construction, environment protection methods and traffic control.

.3 Interim reviews of work progress based on work schedule will be conducted as decided by Owner's Representative and schedule updated by Contractor in conjunction with and to approval of Owner's Representative.

.4 No work will begin until the pre-construction meeting is held.

.5 Following the pre-construction meeting and approval of the schedule and traffic control plan, the work will be so scheduled to meet the time restraints and have the project completed on time.

1.14 SANITARY SERVICES

.1 The Contractor shall provide and maintain sanitary facilities for the use of workers at locations specified by the Owner's Representative. Provision of sanitary facilities shall meet requirements of provincial government and municipal statutes and authorities.

1.15 CONTRACTOR'S USE OF SITE

.1 Use of site: for execution of work within roadway right of way and those areas specified by the Owner's Representative.

1.16 PROJECT MEETINGS

.1 Consultant will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.17 EXISTING SERVICES

.1 Carry out work at times directed by authorities having jurisdiction, 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 Owner's Representative of findings.

.3 Submit schedule to and obtain approval from Owner's 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 Owner's Representative and confirm findings in writing.

.5 Record locations of maintained, re routed and abandoned service lines.

.6 Ensure that at least one lane of traffic is maintained at construction sites at all times.

.7 Ensure pedestrian and other traffic is not unduly impeded, interrupted or endangered by execution

or existence of work or plant.

.8 Maintain existing signs at all times. When it is necessary to temporarily remove a sign, it shall be dismantled and re-established on a temporary post or stand set back from construction area. The work is considered to be incidental and no separate payment will be made for maintaining or moving signs.

.9 Verify locations of any underground utilities.

1.18 ADDITIONAL DRAWINGS

.1 Owner's Representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in Contract documents.

1.19 RELICS, ANTIQUES AND WILDLIFE HABITAT

.1 Protect relics, antiquities, wildlife habitat, items of historical or scientific interest such as cornerstones and contents, animal nesting sites, commemorative plaques, inscribed tablets, and similar objects found during course of work.

.2 Give immediate notice to Owner's Representative and await Owner's Representative's written instructions before proceeding with work in this area.

.3 Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

1.20 MEASUREMENT OF QUANTITIES

.1 Linear: Items which are measured by metre (m) or kilometre (km), such as pavement markings ir piping will be measured along centreline of installation unless otherwise shown on plans.

.2 Area:
.1 Longitudinal and transverse measurements for areas to be measured horizontally in metres (m).
.2 Longitudinal and transverse measurements

for such items as topsoil and hydroseeding to be made on actual flat or sloped surface seeded or sodded.

.3 Volume:

.1 In computing volumes of excavation, average end area method will be used unless otherwise directed by Owner's Representative in writing.

.2 Term: cubic metres or C.M.

.3 All volume measurements refer to in place measure unless specified elsewhere in specification.

.4 Mass:

.1 Term "tonne" shall mean 1000 kg.

.2 Materials which are specified for measurement by mass shall be weighed on scales approved by and at locations designated by Owner's Representative. Units used to haul material being paid for by mass shall bear legible identification numbers plainly visible to scale person as it approaches and leaves scale-house.

.5 Time:

.1 Unless otherwise provided for elsewhere or by written authority of Owner's Representative, hourly rental of equipment will be measured in actual working time and necessary travelling time of equipment within limits of project at an all-inclusive rate. Equip each unit of mobile equipment with an approved device to register hours of operation. Devices which only measure hours of running of motor will not be accepted. Cost for operator of equipment will be included in the hourly rate.

1.21 PERMITS/ AUTHORITIES

.1 The Contractor shall obtain, and pay for, permits from authorities as required for all operations and construction. The Contractor shall also comply with all pertinent regulations of all authorities having jurisdiction over the work. The Contractor shall provide copies of all permits to the Owner prior to starting the work. The Contractor shall be responsible for obtaining all applicable permits, inspections and approvals required and shall pay all charges in connection therewith.

1.22 EQUIPMENT RENTAL RATES

.1 Upon written request, the Contractor will supply the Owner's Representative with a list of the rental equipment to be used on work beyond the scope of bid items. Equipment rental rates will be in accordance with current rates published by the PEI Department of Transportation, Infrastructure and Energy.

END OF SECTION

PART 1 - GENERAL

1.2 Pay Items

.1 Removals:

.1 Unit of Measurement: LUMP SUM (L.S.).

.2 This item includes: the complete removal and off-site disposal (unless noted otherwise) of all structures indicated. The price includes removal of sidewalks,trai storm piping and culverts, and surplus topsoil and any other infrastructure required to complete the work. The price includes all labour, equipment, materials, and payment of all fees required to complete the work.

.2 Locate and Accommodate Existing Systems:

.1 Unit of Measurement: LUMP SUM (L.S.).

.2 This item includes: locating and accommodating all existing infrastructure, for all costs to liaise with all utilities (Maritime Electric, Bell Aliant, Eastlink and Town of Stratford) to locate the existing systems, protect, relocate and accommodate them during construction and maintain service to customers, and return systems all to the satisfaction of the Utility. The price shall include for having the proper utility remove, replace and/or accommodate utility poles, guys and anchors during construction and trace existing buried cables and pipelines. The price shall include all costs associated with reinstatement of areas disturbed by accommodating the existing systems. Also included shall be all costs to excavate test pits to locate infrastructure in plan and profile at crossing points with the proposed pipework and/or services.

.3 Environmental Protection:

.1 Unit of Measurement: LINEAL METER (m), EACH (No.), SQUARE METERS (m^2) or LUMP SUM (L.S.).

.2 Method of Measurement:

.1 Linear meter: along centerline of silt fence, swale, silt sock.

.2 Square Meters: slope measure of indicated area

.3 This item includes: all costs associated with construction and maintenance of silt fence, check dams, sediment control ponds, major drainage swales, jute mat and silt socks in the locations indicated, as directed by the Consultant or as required based on the contractors work methods. The costs shall also include for the removal and disposal of silt build

up from the ponds and check dams and their removal when grass has been re-established.
.4 Sediment Containment Swale, Pond and Major Drainage Swale items include all costs to excavate and stockpile all materials including surficial vegetation, rootmat, topsoil including directing surface or near surface water away from excavated areas, supply and placement of borrow, rip rap, clay plug, excavating, trucking, pumping and draining, compaction, grading, shaping, cutting and filling, top soiling, watering, maintenance and cutting the grass and all other work necessary for a complete installation. The price shall also include for removal and disposal of all unsuitable excavated materials and all equipment, tools, labour, supervising, and incidentals necessary to complete the swales and ponds beyond the R.O.W. boundary.

.4 Clearing and Grubbing
.1 Unit of Measurement: LUMP SUM (L.S.)
.2 This item includes: clearing and grubbing of the right-of-way, green spaces and easements as required to construct the road, ditches, swales, ponds, and install piping and lot services and storm sewer. It also includes clearing and grubbing required in the future sports field areas.

.5 Sanitary Sewer Main:
.1 Unit of Measurement: LINEAL METER (m).
.2 Method of Measurement: along centerline of pipe through manholes.
.3 This item includes: excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level, disposal of surplus and unsuitable material, fittings (including, sleeves, plugs and tees), pipe, supplying and placing of bedding material, lowering into the trench; bringing the pipe into alignment, jointing, testing, and all other work and materials necessary for a complete installation.

.6 Sanitary Sewer Manhole:
.1 Unit of Measurement: EACH (No.).
.2 This item includes: connecting to existing infrastructure, including repair of any existing infrastructure, excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level,

disposal of surplus and unsuitable material, fittings (including sweeps, sleeves, plugs), pipe, supplying and placing of bedding material, lowering into the trench; bringing the pipe into alignment; jointing manholes, (including precast concrete, grade rings, watertight seals, gaskets, frames and covers, plastic sheeting, unshrinkable fill, waterproofing, sealant and bedding material), testing, and all other work and materials necessary for a complete installation.

.7 Sanitary Sewer Service:

.1 Unit of Measurement: Lineal Meter (m).

.2 This item includes: excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level, disposal of surplus and unsuitable material, fittings (including sweeps, sleeves, and plugs), pipe, service markers, supply and placing of bedding material, lowering into the trench; bringing the pipe into alignment; jointing, testing, and all other work and materials necessary for a complete installation.

.8 Closed Circuit Television Inspection:

.1 Unit of Measurement: LUMP SUM (L.S.).

.2 This item includes: on television inspections, records and reports and all other work necessary for a complete inspection.

.9 Sanitary Forcemain:

.1 The unit of Measurement: LINEAL METER (m), EACH (No.) or LUMP SUM (L.S.).

.2 Method of Measurement:

.1 Linear meter: along centerline of pipe through fittings, valves and valve chambers.

.3 This item includes: connecting to existing infrastructure, including repair of any existing infrastructure, excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level, disposal of surplus and unsuitable material, pipe, thrust blocking, chambers (including precast concrete, grade rings, watertight seals, gaskets, frames and covers, plastic sheeting, waterproofing, sealant), valves, valve boxes, excavation, bedding, backfilling, embanking and reinstatement, metal detector conductor, and fittings (including bends, sleeves, saddles, corp. stop, air release valve, and joint restraints), polyethylene wrap, supplying and placing of bedding

material, lowering into the trench; bringing the pipe into alignment; jointing, thrust blocks, testing, and all other work necessary for a complete installation.

.10 Submersible Pumping Station (Lift Station):
.1 Unit of Measurement: LUMP SUM (L.S.).
.2 This item includes: all costs involved for excavation, sheeting, shoring, granular bedding, dewatering, disposal of unsuitable material, removal and disposal of surplus excavated materials, supply and placement of materials, unshrinkable fill, precast structures, frames and covers, guides, equipment, vent pipe, bases, pumps, valves, fittings, piping, forcemain, miscellaneous metals, protective coatings, control building, foundations, doors, roofing, siding, louvers, dampers, ducting, control panel, electrics, underground conduit, discharge piping, backfilling, site work, driveway, topsoiling, grassing, testing including the supply of testing water, all complete and operational in all respects as shown on the Drawings and as specified. This item also includes all the services necessary to integrate the new station into the existing SCADA system.

.11 Water Mains:
.1 The unit of Measurement: LINEAL METER (m).
.2 Method of Measurement: along centerline of pipe through fittings, valves and valve chambers.
.3 This item includes: connecting to existing infrastructure, including repair of any existing infrastructure, excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level, disposal of surplus and unsuitable material, pipe, thrust blocking, insulation, excavation, bedding, backfilling, embanking and reinstatement, metal detector conductor, and fittings (including tees, tapped couplings, bends, caps, sleeves and joint restraints) polyethylene wrap, supplying and placing of bedding material, lowering into the trench; bringing the pipe into alignment; jointing, thrust blocks, testing, disinfection and all other work necessary for a complete installation.

.12 Water Valves:
.1 Unit of Measurement: EACH (No.).
.2 This item includes: connecting to existing infrastructure, including repair of any existing

infrastructure, excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level, disposal of surplus and unsuitable material, valves, valve boxes, valve extensions, anodes, excavation, bedding, backfilling, embanking and reinstatement, supplying and placing of bedding material, lowering into the trench; bringing the pipe into alignment; jointing, thrust blocks, testing, disinfection and all other work necessary for a complete installation.

.13 Fire Hydrant and Valve:

.1 Unit of Measurement: EACH (No.).

.2 This item includes: excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level, disposal of surplus and unsuitable material, hydrant (including marker, tee, valve, piping, thrust blocking, joint restraints, anodes insulation, polyethylene wrap, geotextile fabric, excavation, bedding, backfilling, embanking and reinstatement, hydrant depth of bury changes up to 150 mm from depth shown on the drawings will be considered incidental to the cost of work), metal detector conductor, supplying and placing of bedding material, lowering into the trench; bringing the pipe into alignment; jointing, thrust blocks, testing, disinfection and all other work necessary for a complete installation.

.14 Water Services

.1 Unit of Measurement: EACH (No.).

.2 This item includes: excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surplus level, disposal of surplus and unsuitable material, pipe, valves, insulation, geotextile fabric, excavation, bedding, backfilling, embanking and reinstatement, and fittings (including curb stops, main stops, gate valves & valve boxes) supplying and placing of bedding material, lowering into the trench; bringing the pipe into alignment; jointing, thrust blocks, testing, disinfection and all other work necessary for a complete installation.

.15 Storm Main:
.1 Unit of Measurement: LINEAL METER (m).
.2 Method of Measurement: along centerline of pipe through structures.
.3 This item includes: connecting to existing infrastructure, including repair of any existing infrastructure, excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compacting, maintenance of surface level, disposal of surplus and unsuitable material, lowering into the trench; bringing the pipe into alignment; jointing, supply and installation of bar screens rip rap headwalls, and all other work and materials necessary for a compete installation.

.16 Catch Basins & Tees:
.1 Unit of Measurement: EACH (No.).
.2 This item includes: connecting to existing infrastructure, including repair of any existing infrastructure, excavating, trucking, sheeting and shoring, trench box, pumping and draining, backfilling, compaction, maintenance of surface level, disposal of surplus and unsuitable material, fittings, catch basins including precast concrete, grade rings, watertight seals, gaskets, frames and covers, unshrinkable fill, and grouting, catch tees, supplying and placing of bedding material, lowering into the trench; bringing the pipe into alignment; jointing, testing inlet control devices, and all other work and materials necessary for a complete installation.

.17 Road Construction:
.1 Unit of Measurement: LINEAL METER (m), SQUARE METERS (m^2), CUBIC METERS (m^3)or LUMP SUM (L.S.).
.2 Method of Measurement:
.1 Linear meter: along centerline of road.
.2 Square Meters: slope measure of road granular base
.3 Cubic Meter: in place measure
.3 Item includes: excavation of all materials including topsoil and existing fill from within the roadway, to the depth(s) of location shown on the drawings. The price shall include cutting, filling, compacting and grading, proof rolling, geotechnical testing of base materials, removal of deformable material and replacement with structural fill, shaping/grading the roadway, supply and placement of: select borrow, Class A gravel, fine grading, to achieve the cross slopes

specified. The price shall also include equipment tools, labour, surveying, and incidentals necessary to complete the work as well as disposal of all materials removed from site (unless noted otherwise).

.18 Asphalt Paving:
.1 Unit of Measurement: LINEAL METER (m) or SQUARE METERS (m^2).
.2 Method of Measurement:
.1 Linear meter: along centerline of road.
.2 Square Meters: slope measure of placed asphalt
.3 item includes: asphalt paving, including milled transition, asphalt base, asphalt seal, tack coat, shoulder material, asphalt testing and reporting equipment tools, labour, surveying, and incidentals necessary to complete the work as well as disposal of all materials removed from site (unless noted otherwise).

.19 Traffic Control Devices:
.1 Unit of Measurement: LUMP SUM (L.S.) and NUMBER (No.).
.2 This item includes: supply and installation of all sign posts, anchors, hardware, other miscellaneous materials as required, and sign panels as shown in the Drawings. The price shall also include supply and installation of all traffic striping and pavement marking materials, layout, temporary striping, application, curing, and protection from damage. Contractor is responsible to supply and install all other incidentals, hardware and materials required for complete and fully operational installations.

.20 Active Transportation Trail:
.1 Unit of Measurement: LINEAL METRE (m)
.2 This item includes: excavation of all materials including topsoil to the depths and plan locations shown on the drawings. The price shall include cutting, removal of cut material, filling, compacting and grading, proof rolling, geotechnical testing of base materials, shaping/grading the trail, fine grading and supply and placement of: select borrow, Class A, and asphalt seal to achieve the finished surface and cross slopes specified. The price shall also include equipment, tools, labour, surveying, and incidentals necessary to complete the work as well as disposal of all materials removed from site (unless noted otherwise.)

.21 Reinstatement:

.1 Unit of Measurement: LUMP SUM (L.S.)

.2 This item includes: select borrow, granular base course material, prepare edges of existing pavement, curbing, sidewalk, signage, striping, overlapping of asphalt joints including milling, place, spread and roll asphalt to the compacted thickness indicated on the Drawings. The price shall also include reinstatement of all grass, topsoil, seed, fertilizer, shoulder surfaces and any other disturbed areas to a condition equal to or better than that which existed before construction.

.22 Electrical and Communications

.1 Unit of measurements: LUMP SUM (L.S.) and EACH (No.)

.2 This item includes: all costs involved for accommodating and connecting to existing infrastructure, excavation, sheeting, shoring, sand bedding, granular, dewatering, disposal of surplus material, supply and placement of embankment materials, precast structures, street lighting, bases, poles and fixtures: cabinets, electrical enclosures and all contents; signage, fittings, piping, miscellaneous metal, protective coatings, electrics, underground conduit, conductors, ground rods, transformer pads, base gravel, bollards, bollard covers, power supply, communications, concrete plugs, conduit capping, markers, backfilling, sitework, and testing; utility's charges to have conductors installed and the electrical and communications systems commissioned including co-ordinating the works, all complete and operational in all respects as shown on the Drawings and as specified.

.3 Maritime Electric Allowance: Expenditures under this allowance are to cover all Utility costs to extend power from the adjacent systems. The amounts paid out of this item will be direct charges by Maritime Electric supported by invoices, without mark-up. Any portion of the allowance remaining upon completion of the contract shall be credited to the Owner.

.23 Rigid Insulation (Provisional):
.1 The unit of measurement: SQUARE METRE (m²).
.2 Method of Measurement: the in-place area of rigid board.
.3 This item includes: all costs to supply and install rigid frost insulation in the locations indicated and as directed by the consultant. The price shall also include for required excavation, backfilling and bedding outside the theoretical trench.

.24 General Contingency Allowance
.1 Unit of measurement: Lump Sum (L.S.)
.2 This item includes: Expenditures under The Contingency Allowance shall be authorized In accordance with CCDC 18, GC 4.2. Any Portion of the allowance remaining upon Completion of the contract shall be credited to the owner. No payment will be made under this item unless authorized by the Consultant.

PART 2 - PRODUCTS

2.1 PRODUCTS .1 Not Applicable

PART 3 - EXECUTION

3.1 EXECUTION .1 Not Applicable

END OF SECTION

1.1 RELATED SECTIONS

.1 Section 01 78 00 - Closeout Submittals.

1.2 SUBMITTAL

.1 Submit to Owner's Representative for review requested submittals specified in various sections of the specifications, including shop drawings, samples, permits, compliance certificates, test reports, work management plans and other data required as part of the work.

.2 Submit with reasonable promptness and in orderly sequence so as to allow for Owner's Representative's review and not cause delay in Work. Failure to submit in ample time will not be considered sufficient reason for an extension of Contract time and no claim for extension by reason of such default will be allowed.

.3 Do not proceed with work until relevant submissions have been reviewed.

.4 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.5 Where items or information is not produced in SI Metric units, provide soft converted values.

.6 Review submittals prior to submission. Ensure that necessary requirements have been determined and verified and that each submittal has been checked and coordinated with requirements of Work and Contract Documents.

.1 Submittals not stamped, signed, dated and identified as to specific project will be returned unexamined by Owner's Representative and considered rejected.

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

.8 Notify Owner's Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

1.2 SUBMITTAL (cont'd)

.9 Contractor's responsibility for errors, omissions or deviations in submission from requirements of Contract Documents is not relieved by Owner's Representative's review.

.10 Submittal format: paper originals, or alternatively clear and fully legible photocopies of originals. Facsimiles are not acceptable, except in special circumstances pre-approved by Owner's Representative. Poorly printed non-legible photocopies or facsimiles will not be accepted and will be returned for resubmission.

.11 Make changes or revision to submissions which Owner's Representative may require, consistent with Contract Documents and resubmit as directed by Owner's Representative. When resubmitting, identify in writing of any revisions other than those requested.

.12 Keep one reviewed copy of each submittal document on site for duration of Work.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means fabrication drawings, erection drawings, diagrams, illustrations, schedules, performance charts, technical product data, brochures, specifications, test reports installation instructions and other data which are to be provided by Contractor to illustrate compliance with specified materials and details of a portion of work.

END OF SECTION

1.1 SUBMITTALS

.1 Submit to Owner's Representative copies of the following documents, including updates:
.1 Site Specific Health and Safety Plan.
.2 Name and qualifications of person to be retained full time as H&S Co-Ordinator.

1.2 COMPLIANCE REQUIREMENTS

.1 Comply with the Occupational Health and Safety Act for the Province of Prince Edward Island, and the Occupational Health and Safety Act Regulations made pursuant to the Act.

.2 Comply with Canada Labour Code Part II, and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.

.3 Observe and enforce construction safety measures required by:
.1 National Building Code of Canada;
.2 Provincial Worker's Compensation Board;
.3 Municipal statutes and ordinances.

.4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Owner's Representative will advise on the course of action to be followed.

.5 Maintain Workers Compensation Coverage for duration of Contract. Submit Letter of Good Standing to Owner's Representative upon request.

1.3 RESPONSIBILITY

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

.2 Enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable Federal, Provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.4 SITE CONTROL AND ACCESS

.1 Control work site and entry points to construction areas.
.1 Delineate and isolate construction areas from other areas of site by use of appropriate means.
.2 Post notices and signage at entry points and at other strategic locations identifying entrance onto site to be restricted to authorized persons only.
.3 Signage must be professionally made, bilingual in both official languages or display internationally understood graphic symbols.

.2 Approve and grant access to site only to workers and authorized persons.
.1 Immediately stop non-authorized persons from circulating in construction areas and remove from site.
.2 Provide site safety orientation to all persons before granting access. Advise of site conditions, hazards and mandatory safety rules to be observed on site.

.3 Secure site at nighttime to extent required to protect against unauthorized entry.

.4 Ensure persons granted access to site wear appropriate personal protective equipment (PPE) suitable to work and site conditions.
.1 Provide such PPE to authorized persons who require access to perform inspections or other approved purposes.

1.5 PROTECTION

.1 Carry out work placing emphasis on health and safety of the Public, Facility personnel, construction workers and protection of the environment.

.2 Erect safety barricades, lights and signage on site to effectively delineate work areas, protect pedestrian and vehicular traffic around and adjacent to work and to create a safe working environment.

.3 Should unforeseen or peculiar safety related hazard or condition become evident during

performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Owner's Representative verbally and in writing.

1.6 FILING OF NOTICE

.1 File Notice of Project and other Notices with Provincial authorities prior to commencement of Work.

1.7 PERMITS

.1 Post on site permits, licenses, compliance certificates specified in section 01 10 10.

.2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Owner's Representative in writing and obtain his/her approval to proceed before carrying out that portion of work.

1.8 HAZARD ASSESSMENTS

.1 Conduct site specific health and safety hazard assessment before commencing project and during course of the work. Identify risks and hazards resulting from site conditions, weather conditions and work operations.
.1 Also, conduct assessment when the scope of work has been changed by Change Order and when potential hazard or weakness in current health and safety practices are identified by Owner's Representative or by an authorized safety Representative.

.2 Record results in writing and address in Health and Safety Plan.

.3 Keep copy of all assessments on site.

1.9 PROJECT/SITE CONDITION

.1 The following are known or potential project related health, environmental and safety hazards at site which must be properly managed if encountered during course of work:
.1 Existing hazardous products are:
.1 Petroleum products and fuels for equipment.

.2 Above list shall not be construed as being

complete and inclusive of potential health, and safety hazards encountered during work. Include above items into hazard assessment process.

1.10 HEALTH AND SAFETY MEETINGS

.1 Conduct a pre-construction health and safety meeting. Have following persons in attendance:
.1 Site Superintendent.
.2 Health & Safety Site Coordinator.
.3 Owner's Representative.

1.11 SAFETY SUPERVISION AND INSPECTIONS

.1 Designate one person to be present on site at all times, responsible for supervising health and safety of the Work.
.1 Person to be competent in Occupational Health and Construction Safety as defined in the Provincial Occupational Health and Safety Act.

.2 Assign responsibility, obligation and authority to such designated person to stop work as deemed necessary for reasons of health and safety.

.3 Conduct regularly scheduled informal safety inspections of work site on a minimum bi-weekly basis.
.1 Note deficiencies and remedial action taken in a log book or diary.

.4 Keep inspection reports on site.

1.12 TRAINING

.1 Ensure that all workers and other persons granted access to site are competently trained and knowledgeable on:
.1 Safe use of tools and equipment.
.2 How to wear and use personal protective equipment (PPE).
.3 Safe work practices and procedures to be followed in carrying out work.
.4 Site conditions and minimum safety rules to be observed on site, as given at site orientation session.

1.13 MINIMUM SITE SAFETY RULES

.1 Notwithstanding the requirement to abide by federal and provincial health and safety

regulations, the following safety rules shall be considered minimum requirements to be obeyed by all persons granted site access:

.1 Wear personnel protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear and eye protection.

.2 Immediately report unsafe activity or condition at site, near-miss accident, injury and damage.

.3 Maintain site in tidy condition.

.4 Obey warning signs and safety tags.

.2 Brief workers on site safety rules.

1.14 ACCIDENT REPORTING

.1 Investigate and report the following incidents and accidents:

.1 Those as required by Provincial Occupational Safety and Health Act and Regulations.

.2 Injury requiring medical aid as defined in the Canadian Dictionary of Safety Terms-1987, published by the Canadian Society of Safety Engineers (C.S.S.E)as follows:

.1 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.

.2 Those which require notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable law or regulations.

.2 Send written report to Owner's Representative for all above cases.

1.15 TOOLS AND EQUIPMENT SAFETY

.1 Routinely check and maintain tools, equipment and machinery for safe operation.

.2 Conduct checks as part of site safety inspections. When requested, submit proof that checks and maintenance have been carried out.

.3 Tag and immediately remove from site items found faulty or defective.

1.16 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS).

.2 Keep MSDS data sheets for all products delivered to site. Post on site. Submit copy to Owner's Representative upon receipt.

1.17 CONFINED SPACES

.1 Carry out work in confined spaces in compliance with:
.1 Provincial Occupational Safety and Health Regulations and;
.2 Canada Occupational Safety and Health Regulations (COSH) made under the Canada Labour Code - Part II.

.2 Conduct hazard assessment and address in Safety Plan before entering confined space.

1.18 POSTING OF DOCUMENTS

.1 Post on site safety documentation as stipulated by Authorities having jurisdiction and as specified herein. Place in a common visible location.

1.19 SITE RECORDS

.1 Maintain on site a copy of all health and safety documentation and reports specified to be produced as part of the work and received from authorities having jurisdiction.

.2 Upon request, make available to Owner's Representative and to other authorized safety representative for review. Provide copy when directed by Owner's Representative.

1.20 NON-COMPLIANCE AND DISCIPLINARY MEASURES

.1 Immediately address and correct health and safety violations and non-compliance issues.

END OF SECTION

1.1 SUBMITTALS

.1 Submit to Owner's Representative copies of the following documents, including updates:
.1 Site Specific Health and Safety Plan.
.2 Name and qualifications of person to be retained full time as H&S Co-Ordinator.

1.2 COMPLIANCE REQUIREMENTS

.1 Comply with the Occupational Health and Safety Act for the Province of Prince Edward Island, and the Occupational Health and Safety Act Regulations made pursuant to the Act.

.2 Comply with Canada Labour Code Part II, and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.

.3 Observe and enforce construction safety measures required by:
.1 National Building Code of Canada;
.2 Provincial Worker's Compensation Board;
.3 Municipal statutes and ordinances.

.4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Owner's Representative will advise on the course of action to be followed.

.5 Maintain Workers Compensation Coverage for duration of Contract. Submit Letter of Good Standing to Owner's Representative upon request.

1.3 RESPONSIBILITY

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

.2 Enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable Federal, Provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.4 SITE CONTROL AND ACCESS

.1 Control work site and entry points to construction areas.
.1 Delineate and isolate construction areas from other areas of site by use of appropriate means.
.2 Post notices and signage at entry points and at other strategic locations identifying entrance onto site to be restricted to authorized persons only.
.3 Signage must be professionally made, bilingual in both official languages or display internationally understood graphic symbols.

.2 Approve and grant access to site only to workers and authorized persons.
.1 Immediately stop non-authorized persons from circulating in construction areas and remove from site.
.2 Provide site safety orientation to all persons before granting access. Advise of site conditions, hazards and mandatory safety rules to be observed on site.

.3 Secure site at nighttime to extent required to protect against unauthorized entry.

.4 Ensure persons granted access to site wear appropriate personal protective equipment (PPE) suitable to work and site conditions.
.1 Provide such PPE to authorized persons who require access to perform inspections or other approved purposes.

1.5 PROTECTION

.1 Carry out work placing emphasis on health and safety of the Public, Facility personnel, construction workers and protection of the environment.

.2 Erect safety barricades, lights and signage on site to effectively delineate work areas, protect pedestrian and vehicular traffic around and adjacent to work and to create a safe working environment.

.3 Should unforeseen or peculiar safety related hazard or condition become evident during

performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Owner's Representative verbally and in writing.

1.6 FILING OF NOTICE

.1 File Notice of Project and other Notices with Provincial authorities prior to commencement of Work.

1.7 PERMITS

.1 Post on site permits, licenses, compliance certificates specified in section 01 10 10.

.2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Owner's Representative in writing and obtain his/her approval to proceed before carrying out that portion of work.

1.8 HAZARD ASSESSMENTS

.1 Conduct site specific health and safety hazard assessment before commencing project and during course of the work. Identify risks and hazards resulting from site conditions, weather conditions and work operations.
.1 Also, conduct assessment when the scope of work has been changed by Change Order and when potential hazard or weakness in current health and safety practices are identified by Owner's Representative or by an authorized safety Representative.

.2 Record results in writing and address in Health and Safety Plan.

.3 Keep copy of all assessments on site.

1.9 PROJECT/SITE CONDITION

.1 The following are known or potential project related health, environmental and safety hazards at site which must be properly managed if encountered during course of work:
.1 Existing hazardous products are:
.1 Petroleum products and fuels for equipment.

.2 Above list shall not be construed as being

complete and inclusive of potential health, and safety hazards encountered during work. Include above items into hazard assessment process.

1.10 HEALTH AND SAFETY MEETINGS

.1 Conduct a pre-construction health and safety meeting. Have following persons in attendance:
.1 Site Superintendent.
.2 Health & Safety Site Coordinator.
.3 Owner's Representative.

1.11 SAFETY SUPERVISION AND INSPECTIONS

.1 Designate one person to be present on site at all times, responsible for supervising health and safety of the Work.
.1 Person to be competent in Occupational Health and Construction Safety as defined in the Provincial Occupational Health and Safety Act.

.2 Assign responsibility, obligation and authority to such designated person to stop work as deemed necessary for reasons of health and safety.

.3 Conduct regularly scheduled informal safety inspections of work site on a minimum bi-weekly basis.
.1 Note deficiencies and remedial action taken in a log book or diary.

.4 Keep inspection reports on site.

1.12 TRAINING

.1 Ensure that all workers and other persons granted access to site are competently trained and knowledgeable on:
.1 Safe use of tools and equipment.
.2 How to wear and use personal protective equipment (PPE).
.3 Safe work practices and procedures to be followed in carrying out work.
.4 Site conditions and minimum safety rules to be observed on site, as given at site orientation session.

1.13 MINIMUM SITE SAFETY RULES

.1 Notwithstanding the requirement to abide by federal and provincial health and safety

regulations, the following safety rules shall be considered minimum requirements to be obeyed by all persons granted site access:

.1 Wear personnel protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear and eye protection.

.2 Immediately report unsafe activity or condition at site, near-miss accident, injury and damage.

.3 Maintain site in tidy condition.

.4 Obey warning signs and safety tags.

.2 Brief workers on site safety rules.

1.14 ACCIDENT REPORTING

.1 Investigate and report the following incidents and accidents:

.1 Those as required by Provincial Occupational Safety and Health Act and Regulations.

.2 Injury requiring medical aid as defined in the Canadian Dictionary of Safety Terms-1987, published by the Canadian Society of Safety Engineers (C.S.S.E)as follows:

.1 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.

.2 Those which require notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable law or regulations.

.2 Send written report to Owner's Representative for all above cases.

1.15 TOOLS AND EQUIPMENT SAFETY

.1 Routinely check and maintain tools, equipment and machinery for safe operation.

.2 Conduct checks as part of site safety inspections. When requested, submit proof that checks and maintenance have been carried out.

.3 Tag and immediately remove from site items found faulty or defective.

1.16 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS).

.2 Keep MSDS data sheets for all products delivered to site. Post on site. Submit copy to Owner's Representative upon receipt.

1.17 CONFINED SPACES

.1 Carry out work in confined spaces in compliance with:
.1 Provincial Occupational Safety and Health Regulations and;
.2 Canada Occupational Safety and Health Regulations (COSH) made under the Canada Labour Code - Part II.

.2 Conduct hazard assessment and address in Safety Plan before entering confined space.

1.18 POSTING OF DOCUMENTS

.1 Post on site safety documentation as stipulated by Authorities having jurisdiction and as specified herein. Place in a common visible location.

1.19 SITE RECORDS

.1 Maintain on site a copy of all health and safety documentation and reports specified to be produced as part of the work and received from authorities having jurisdiction.

.2 Upon request, make available to Owner's Representative and to other authorized safety representative for review. Provide copy when directed by Owner's Representative.

1.20 NON-COMPLIANCE AND DISCIPLINARY MEASURES

.1 Immediately address and correct health and safety violations and non-compliance issues.

END OF SECTION

1.1 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures

1.2 INSPECTION

.1 Give timely notice requesting inspection of Work designated for special tests, inspections or approvals by Owner's Representative or by inspection authorities having jurisdiction.

.2 In accordance with the General Conditions, Owner's Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents.

.3 If Contractor covers or permits to be covered Work designated for special tests, inspections or approvals before such is made, uncover Work until particular inspections or tests have been fully and satisfactorily completed and until such time as Owner's Representative gives permission to proceed.

.4 Pay costs to uncover and make good work disturbed by inspections and tests.

1.3 TESTING

.1 The Contractor shall retain a Geotechnical Engineer to carry out the required testing as outlined in the specification.

.2 Tests on materials, as specified in various sections of the Specifications is the responsibility of the Contractor except where stipulated otherwise.
.1 Provide all necessary instruments, equipment and qualified personnel to perform tests.

.3 At completion of tests, turn over 2 sets of fully documented tests reports to the Owner's Representative. Submit in accordance with Section 01 33 00.
.1 Obtain additional copies for inclusion of a complete set in each of the maintenance manuals specified in Section 01 78 00.

.4 Unspecified tests may also be made by Owner's Representative, at the discretion of the Owner's Representative. The costs of these tests will

be paid for by the Owner's Representative.

.5 Where tests or inspections reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests and inspections incurred by Owner's Representative as required to verify acceptability of corrected work.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 When specified or directed, submit Representative samples of materials, in required quantities, to Testing Agency for testing purposes. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.2 Provide labour and facilities to obtain, handle and deliver samples.

.3 Provide sufficient space on site for Testing Agency's exclusive use to store equipment and cure test samples.

1.5 ACCESS TO WORK

.1 Facilitate Owner's Representative's access to Work. If part of Work is being fabricated at locations other than construction site, make preparations to allow access to such Work whenever it is in progress.

.2 Furnish labour and facility to provide access to the work being inspected and tested.

.3 Co-operate to facilitate such inspections and tests.

1.6 REJECTED WORK

.1 Remove and replace defective Work, whether result of poor workmanship, use of defective or damaged products and whether incorporated in Work or not, which has been identified by Owner's Representative as failing to conform to Contract Documents.

.2 Make good damages to new construction and finishes resulting from removal or replacement of defective work.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section is to provide traffic control pursuant to Section 6 of the Provincial Roads Act as stipulated in the PEI Temporary Workplace Traffic Control Manual (TWTCM).

1.2 RELATED WORK

.1 General Instructions - Section 01 10 10

.2 Health and Safety Requirements - Section 01 35 28

1.3 REFERENCE STANDARD

.1 Regulate traffic in accordance with the Roads Act (Prince Edward Island) as stipulated in the TWTCM distributed by the Prince Edward Island Department of Transportation and Infrastructure.

.2 The Owner's Representative reserves the right to direct the contractor to reduce either the number or length of traffic control work areas during peak traffic volumes or when cumulative delays exceed the specified maximum.

1.4 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.

.2 When working on travelled way:
.1 Place equipment in position to present minimum of interference and hazard to travelling public.
.2 Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.
.3 Do not leave equipment on travelled way overnight.

.3 Do not close any lanes of roadway without approval of Owner's Representative. Before

rerouting traffic, erect suitable signs and devices in accordance with instructions contained in the TWTCM. Provide sufficient crushed gravel to ensure a smooth riding surface during work.

.4 Keep travelled way well graded, free of pot holes and of sufficient width that required number of lanes of traffic may pass.

.5 Limit construction to maintain at least one lane of traffic at all times.

.6 When directed by Owner's Representative, provide well graded, detours or temporary roads to facilitate passage of traffic around restricted construction area. Provide and maintain signs and lights and maintain roadway.

.7 Provide and maintain reasonable road access and egress to property fronting along or in vicinity of work under Contract unless approved otherwise by Owner's Representative.

.8 Contractor must make provisions to transport cyclists and their bicycles thru activity work zones while pilot vehicle operations are in place.

1.5 INFORMATIONAL & WARNING DEVICES

.1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from project work which may require road user response.

.2 All traffic signs are to be bilingual or symbolic and shall be Level 1 reflectivity.

.3 Supply and erect signs, declinators, barricades and miscellaneous warning devices as specified in TWTCM.

.4 Place signs and other devices in locations recommended in the TWTCM.

.5 The contractor shall provide an Accredited Sign Supervisor, who has successfully completed the Temporary Workplace Traffic Control Training

Course, to be on site at all times when active construction is taking place. The Accredited Traffic Control Sign Supervisor will be responsible to supervise the placement and dismantling of all temporary condition signs and devices that indicate to the road user that highway construction activity exist and also to ensure that proper traffic control procedures are carried out in accordance with the TWTCM. The Accredited Sign Supervisor is considered part of the contractors supervision and administration staff and compensation the provision this individual is considered incidental to the work.

.6 A traffic control plan must be approved by the engineer prior to commencing any work.

.7 Continually maintain traffic control devices in use by:
.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
.2 Removing or covering signs which do not apply to conditions existing from day to day.

1.6 CONTROL OF PUBLIC TRAFFIC

.1 Provide traffic control personnel who have a valid provincial license and trained in accordance with and properly equipped as specified in the TWTCM, in following situations:
.1 When public traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.
.2 When it is necessary to institute one way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
.3 When workers or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
.4 Where temporary protection is required while other traffic control devices are being erected or taken down.
.5 For emergency protection when other traffic control devices are not readily

available.
.6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.2 All Traffic Control Personnel shall be equipped with portable radios of sufficient range to ensure continuous communication within the traffic control zone.

.3 All construction vehicles shall operate in accordance with and are subject to traffic control restrictions and operations in place on the project.

1.7 TRAFFIC MANAGEMENT PLAN REQUIREMENT

.1 Contractor to provide a detailed traffic management plan, prior to construction.

.2 Traffic control measures are summarized as follows:
.1 Single lane traffic will be maintained at all times and will be a contract obligation.
.2 Complete road closures will not be permitted, unless some exceptional circumstances arise.
.3 Radio communications and one-way traffic controls will be used.

.3 The required traffic measures will be included in the construction contract. A detailed construction sequencing and Traffic Management Plan will be required prior to construction. On-going information and communications will be maintained throughout the construction period.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, five final copies of operating and maintenance manuals in English.

.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.

1.3 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.
.1 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.

1.3 FORMAT (cont'd)

.8 Drawings: provide with reinforced punched binder tab.
.1 Bind in with text; fold larger drawings to size of text pages.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.
.2 Addresses, and telephone numbers of Consultant 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.
.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.5 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.
.1 Give function, normal operation characteristics and limiting conditions.
.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of

1.5 EQUIPMENT AND SYSTEMS (Cont'd)

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.
.1 Include regulation, control, stopping, shut-down, and emergency instructions.
.2 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.

1.6 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 for review by Consultant.

1.7 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 Consultant approval.

.3 Warranty management plan to include required actions and documents to assure that Owner 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 Assemble approved information in binder, submit upon acceptance of work and 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.

1.7 WARRANTIES AND BONDS (Cont'd)

.5 Co-execute submittals when required.
.6 Retain warranties and bonds until time specified for submittal.

.6 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.

.7 Conduct joint 9 month warranty inspection, measured from time of acceptance, by Consultant.

.8 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 pumps, motors, 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

1.7 WARRANTIES AND BONDS (Cont'd)

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 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.

.9 Respond in timely manner to oral or written notification of required construction warranty repair work.

.10 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Departmental Representative DCC Representative Consultant to proceed with action against Contractor.

1.8 WARRANTY TAGS

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

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 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 WORK INCLUDED

.1 This section includes providing all labour, tools, materials, and equipment to perform all cast-in-place concrete work.

1.2 RELATED WORK

.1 Watermains: Section 33 11 00

.2 Reinstatement: Section 32 98 00

.3 Submersible Pumping Station – Section 33 32 14

.4 Forcemains: Section 33 34 00

1.3 REFERENCES

.1 ASTM C260/C260m-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C494/C494M-17, Specification for Chemical Admixtures for Concrete.

.3 ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C827/C827M-16, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

.5 ASTM C939/C939M-16a, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).

.6 ASTM D1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

.7 CSA-A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction/Test methods and Standard Practices for Concrete.

.8 CSA-A3000-18, Cementitious Materials Compendium.

.9 DIN 1048-5, Testing of Concrete: Testing of Hardened Concrete (Specimens Prepared in Mould).

.10 CRD C49-92, Standard Test Method For Water Permeability of Concrete.

.11 ASTM C1585-2013, Standard Test Method for Measurement of Rate of Absorption of Water by Hydraulic Cement Concretes.

.12 ASTM C39/C39M-18, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

.13 ASTM C1202-19, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.14 ASTM C157/C157M-17, Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.

1.4 SAMPLES

.1 At least four (4) weeks prior to commencing work, inform the Consultant of proposed source of aggregates and provide access for sampling.

1.5 CERTIFICATES

.1 Minimum four (4) weeks prior to starting concrete work submit to the Consultant manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:

- .1 Portland cement.
- .2 Supplementary cementing materials.
- .3 Grout.
- .4 Admixtures.
- .5 Aggregates.
- .6 Water.
- .7 Waterstops.
- .8 Waterstop joints.

.2 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA-A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.3 Provide certification that plant, equipment and materials to be used in concrete comply with requirements of CAN/CSA A23.1.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with applicable local, provincial and national regulations.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate a cleaning area for tools to limit water use and runoff.

.4 Carefully coordinate the specified concrete work with weather conditions.

.5 Seal emptied containers and store safely for disposal away from children.

.6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

.7 Choose least harmful, appropriate cleaning method which will perform adequately.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Portland cement: to CSA A3000.

.2 Supplementary cementing materials: to CSA A3000.

.3 Water: to CAN/CSA-A23.1.

.4 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.

.5 Air entraining admixture: to ASTM C260.

.6 Chemical admixtures: to ASTM C494. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing. All admixtures to be approved for use in potable water containing structures.

.7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
.1 Compressive strength: 50 MPa at 28 days.
.2 Consistency:
.1 Fluid: to ASTM C827. Time of efflux through flow cone (ASTM C939), under 30 s.
.2 Flowable: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portion) 125 to 145%.
.3 Plastic: to ASTM C827. Flow table, 5 drops in 3 s, (ASTM C109, applicable portions) 100 to 125%.
.4 Dry pack to manufacturer's requirements.

.8 Curing compound: to CAN/CSA-A23.1 and to ASTM C309, Type 1-D with fugitive dye for hidden or exterior use, and Type 1 for exposed concrete. Curing compounds to be approved for use in potable water containing structures.

.9 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

2.2 CONCRETE MIXES

.1 Mix 1: Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give following properties for curbs, and exterior pads walkways.
.1 Cement: Type GU.
.2 Minimum compressive strength at 28 days: 32 MPa.
.3 Class of exposure: C-2
.4 Nominal size of coarse aggregate: 20mm
.5 Slump at time and point of discharge: 80±30mm

.6 Air content: 5-8%
.7 Chemical Admixtures: type as approved and in accordance with ASTM C494.

.2 Mix 2: Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1, to give the following properties for concrete thrust blocks, manhole benching and hold down slab:
.1 Cement Type: 10.
.2 Minimum compressive strength at 28 days: 25 MPa.
.3 Class of exposure: F-2
.4 Nominal size of coarse aggregate: 20mm.
.5 Slump at point of discharge: 80mm,±30mm.
.6 Air content: 4-7%
.7 Chemical admixtures: as approved by the Engineer and in accordance with ASTM C494.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Confirm the founding material on which footings and other concrete work are to be placed are free from water. Place concrete only on frost-free ground. Remove previously frozen bearing surfaces.

.2 Confirm foundations, including mud slabs, bear on bedrock, undisturbed till or structural fill. All structural fill to be placed as directed and under the continuous supervision of the Consultant.

.3 Foundation bearing surfaces will be subject to inspection and approval by a geotechnical engineer prior to placing concrete. If bearing surfaces are deemed unacceptable because conditions do not meet those anticipated during design, make adjustments as directed.

.4 Confirm the fill has been placed to meet specified requirements, and that underslab services have been installed, inspected, tested and approved.

3.2 WORKMANSHIP

.1 Obtain Consultant's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.

.2 Pumping of concrete is permitted only after approval of equipment and mix.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Prior to placing of concrete obtain Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place dowels and epoxy grout according to epoxy manufacturer's specifications.

.7 Do not place load upon new concrete until authorized by the Consultant.

.8 Concrete protective cover to reinforcement is as indicated on the drawings.

.9 Bars in suspended slabs and slabs-on-grade are to be accurately supported on plastic coated steel chairs to maintain exact cover requirements.

.10 Confirm all concrete construction is moist cured using either an approved curing compound or burlap maintained in moist conditions. For walls of water retaining structures, leave forms in place for a minimum of three (3) days after placement of concrete. After three (3) days, forms can be stripped and concrete can be moist cured as described above.

.11 In cold weather protect concrete Work to CAN/CSA-A23.1 and following:
.1 Cold weather is defined as a period when the mean air temperature drops below 5°C for more than three successive days.

.2 When air temperature is above 0°C and is forecast to remain so for 48 hours after placing, insulated tarps are acceptable protection provided concrete temperatures are monitored and comply with temperature limits specified in the following paragraph.

.3 For all other cold weather conditions protect concrete with a windproof enclosure of canvas or other material to allow free circulation of inside air around fresh concrete. At no point let walls of enclosure touch formwork and provide sufficient space for removal of formwork and for finishing. Supply approved heating equipment capable of keeping inside air at sufficient curing temperatures:

.1 For an initial three days, at a temperature of not less than 15°C.

.2 Maintain concrete at temperatures of not less than 10°C for a total period of seven days plus the initial three days specified above.

.3 At no time shall concrete temperatures exceed 30°C at surfaces.

.4 Reduce enclosure air temperature at a rate not exceeding 10°C per day until outside air temperature has been reached.

.5 Take temperature readings both of air and of concrete surfaces at several points within area protected at start and at end of working day. Maintain complete records of temperature readings.

.4 Protect concrete from damage during curing. When enclosure is provided, avoid rapid drying of the concrete.

.12 In hot weather protect concrete Work to CAN/CSA-A23.1 and following:

.1 When air temperature is at or above 25°C, do not use curing compounds and keep concrete surfaces moist continually during protection stage using burlap maintained in a moist condition.

.2 Regulate the generation of heat through hydration to control thermal gradients to prevent thermal cracking.

3.3 INSERTS

.1 Do not pass sleeves, ducts, pipes or other openings through joists, beams, walls, slabs,

column capitals or columns, except where indicated or approved by Consultant.

.2 Where approved by the Consultant, set sleeves, ties, pipe hangers, miscellaneous metals and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100mm x 100mm not indicated, must be approved by the Consultant.

.3 Maximum diameter of core-drilled holes is 200 mm. Proposed core-drilled penetrations must be approved by the Consultant and concrete shall be scanned to locate reinforcing prior to the placement of concrete.

.4 Do not eliminate or displace reinforcement to accommodate hardware larger than 400 mm. For inserts/ hardware less than 400 mm, displace bars to accommodate. If inserts cannot be located as specified, obtain approval of modifications from Consultant before placing concrete.

.5 Coordinate locations and sizes of sleeves and openings shown on structural and civil drawings with mechanical and electrical drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.7 Larger size openings in walls and slabs have been shown on the structural drawings. Refer to process drawings for all remaining cast-in-place concrete penetrations. All pipe sleeves containing wall flanges will be cast-in-place at time of concrete pour.

3.4 PLACING CONCRETE

.1 Place concrete as specified in CAN/CSA-A23.1.

.2 Inform Consultant at least 24 hours before each concrete placing operation.

.3 Do not place concrete when it is raining or likely to rain. If rain begins after concrete is placed, protect with waterproof covers until set.

.4 Do not permit vertical free fall of concrete mix

to exceed 1.5 metres.

.5 For exposed concrete, and concrete tanks, take special precautions when placing to prevent segregation of concrete, and to avoid cold joints, honeycombing or voids. Do not allow vibrator to touch formwork.

.6 Use form vibrators only when sections are too narrow for internal type. Employ a sufficient number of vibrators to ensure complete consolidation of concrete throughout entire volume of each layer. Have available at least one (1) extra vibrator on hand for emergency.

.7 Do not use vibrators for interior and exterior concrete slabs on fill.

.8 Use only tools and handling equipment that are clear of rust or other harmful and foreign material to avoid effervescence and staining of slabs or hardened concrete.

.9 Use concrete pumps to place concrete only with approval of methods, equipment and mix design.

.10 Provide continuous supervision during placement of concrete including concrete grout to ensure reinforcing steel is maintained in correct position.

.11 Fill all bug holes with depth greater than 6 mm and/or diameter greater than 10 mm (surface air voids) in wall faces within the new building with non-shrink grout.

.12 Allow minimum of 48 hours between pours of adjacent wall and foundation slab sections in water retaining structures.

3.5 PLACING GROUT

.1 Grout where indicated using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

3.6 SURFACE TOLERANCE

.1 Concrete tolerance in accordance with CAN/CSA-A23.1, straight edge method.

3.7 FINISHING

.1 Finish concrete in accordance with CAN/CSA-A23.1.

.2 Use smooth form finish for all concrete surfaces. Use form facing material that will produce a smooth, hard, uniform texture on the concrete. Do not use material with raised grain, torn surfaces, worn edges, patches, dents or other defects that will impair the texture of the concrete surface. Patch the holes and defects. Patch smooth bug holes exceeding 10 mm in diameter and/or 6 mm in depth. Completely remove all fins in all water holding tankage and water holding conduits.

.3 Remove tie cones and patch with latex modified concrete finish. Mix to be in strict accordance with manufacturers instructions.

.4 Use rubbed finish for all interior concrete exposed to view. Remove fins exceeding 3 mm in height.

.5 Provide steel trowel finish surfaces to floor in accordance with CAN/CSA-A23.1, Classification A.
.1 Floor finisher shall inspect grades, lines, inserts and floor drains prior to commencement of work.
.2 Correct floor flatness and waviness deficiencies by grinding.
.3 Coordinate floor finishing with epoxy floor coating applicator in areas to receive concrete treatments.

.6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.7 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

3.8 WATERSTOPS

.1 Install waterstops to provide continuous water seal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.

.2 Use only straight heat sealed butt joints in field. Use factory or field welded corners and intersections unless otherwise approved by Consultant.

.3 Provide waterstops as required to provide continuous seal and as indicated on the drawings and at all construction joints in water-retaining structures. Note: not all waterstops are indicated on the Drawings.

.4 Install expansion joint waterstops in accordance with manufacturer's directions.

3.9 FIELD QUALITY CONTROL

.1 Have inspection and testing of concrete and concrete materials carried out by a Testing Laboratory approved by Owner in accordance with CAN/CSA-A23.1. Pay for the cost of testing.

.2 A set of four (4) test cylinders to be provided for each class of concrete placed each day (only 3 will typically be tested). Provide one (1) set of test cylinders per each 50 m^3.

.3 Consultant will require additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.4 Do non-destructive methods for testing concrete in accordance with CAN/CSA-A23.2.

.5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for furnishing all materials, labour, tools and equipment, and performing all operations necessary to complete all miscellaneous metal and fabricated items, as shown on the Drawings and specified herein.

.2 The work shall generally include the following categories and all related items of miscellaneous metal shown on the Drawings.
- .1 Anchor bolts, inserts and fasteners
- .2 Miscellaneous steel
- .3 Ladders

1.2 RELATED WORK

.1 Submersible Pumping Station: Section 33 32 14

.2 Forcemains: Section 33 34 00

1.3 REFERENCES

.1 ASTM A53-07, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.2 ASTM A123-09, Standard for Zinc-Dipped (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A307-07b, Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

.4 CSA G40.20-04/G40.21-04 (R2009), Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding).

.6 CSA W59.2-03 (R2008), Welded Aluminum Construction,.

1.4 SHOP DRAWINGS

.1 Submit shop drawings for all metal fabrications in accordance with Section 01 33 00.

1.4 SHOP DRAWINGS (Cont'd)

.2 Clearly indicate materials, core thickness, finishes, connections, joints, method of attachment, number of anchors, support, reinforcement, details and accessories.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Label, tag or otherwise mark items supplied for installation by other sections to indicate its function, location, and shop drawing designation.

1.6 JOB CONDITIONS

.1 Protection:

.1 Maintain protection of Work of this Section from time of installation until final finishes are applied.

.2 Protect galvanized surfaces from damage.

.3 Protect exposed surfaces of prefinished metal work which does not receive site finishing with protective coatings or wrappings. Use materials recommended by finishers or manufacturers of metals to ensure that method is sufficiently protective, easily removed, and harmless to the finish.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Steel sections and plates: to CSA-G40.21M, 260W.

.2 Steel pipe: to ASTM A53, standard weight, galvanized finish.

.3 Welding materials: to W59 for steel and CSA W59.2.

.4 Bolts and anchor bolts: to ASTM A307.

.5 Galvanizing: hot-dip method with minimum zinc coating of 600g/m^2 conforming to ASTM A123.

.6 Galvanized primer: zinc-rich, ready mix conforming to CAN/CGSB-1.181.

2.2 FABRICATION

.1 Workmanship and finish shall be equal to the best practice of modern shops for each item of work.

.2 Build work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.3 Exposed surfaces shall have smooth finish and sharp, well defined lines and arises. Sections shall be well formed to shape and size with sharp lines and angles.

.4 Castings shall have sharp corners and edges, and shall be clean, smooth and true to pattern.

.5 Exposed welds shall be continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 MISCELLANEOUS METALWORK ITEMS

.1 Anchors, bolts and inserts, furnished as necessary to fasten miscellaneous metal items to concrete. Where sizes, kinds and spacing of anchors are not indicated or specified, provide as necessary for the purpose as approved by Engineer. All anchors, bolts and inserts to be galvanized or stainless steel.

.2 Miscellaneous steel: fabricate angles, equipment supports, and steel framing from steel conforming to CSA G40.21M, galvanized to ASTM A123.

.3 Pipe supports:
.1 Fabricate support post from Schedule 40 steel pipe.
.2 Fabricate baseplate, stiffeners, and pipe saddle from structural steel plate thickness indicated.
.3 Provide rods, nuts and washers as indicated.
.4 Galvanize after fabrication.

.4 Inlet baffles, steel bollards, pipe supports and equipment supports as specified on the Project Drawings.

PART 3 - EXECUTION

3.1 FIELD MEASUREMENTS

.1 Verify dimensions and perform field measurements required to assure that items function properly when installed.

.2 Details of proposed departures due to field conditions or other causes to be submitted to the Engineer for approval.

3.2 INSTALLATION

.1 Install miscellaneous metal items in the locations shown on the Drawings.

.2 Install plumb and true using welded connections wherever possible to provide rigid structures. Provide anchor bolts, bolts and plates as necessary for connecting to structure of types acceptable to Engineer.

.3 Hand over items for casting into concrete to appropriate trades together with setting templates. Coordinate inserts with supplier of precast concrete structures.

.4 Exposed fastening devices to match finish, and to be compatible with material thorough which they pass.

.5 Touch-up field welds, bolts, and burnt or scratched surfaces with primer, followed by two (2) coats of finish paint after installation.

.6 Touch-up galvanized surfaces with inorganic zinc-rich paint. Surfaces to be cleaned, free of oil and grease and corrosion prior to application of paint.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for providing all labour, tools, materials, and equipment for exterior waterproofing (horizontal and vertical) on below grade exterior surfaces of noted sanitary manholes and lift station as indicated on drawings.

1.2 RELATED WORK

.1 Cast-in-place concrete: Section 03 30 00

.2 Submersible Pumping Station: Section 33 32 14

.3 Precast Structures: Section 33 39 00

1.3 QUALITY ASSURANCE

.1 Membrane: applied by applicator trained and approved by manufacturer for application of its products.

.2 Applicators: minimum 5 years proven experience.

.3 Contractor shall notify manufacturer's representative as to work start-up by applicator.

.4 Manufacturer's representative:
.1 Inspect substrate prior to commencement of work, during application of membrane and upon completion of work.
.2 Provide technical assistance to applicator and assist where required in correct installation of membrane.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

.5 Store role materials in original packaging.

.6 Store adhesives and primers at temperatures of 5°C and above to facilitate handling.

.7 Keep solvent away from open flame or excessive heat.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.5 Protect rolls from direct sunlight until ready for use.

1.5 COORDINATION

.1 Ensure continuity of the waterproofing membrane throughout the scope of this section.

1.6 ENVIRONMENTAL PROTECTION

.1 Provide forced air circulation during installation and curing periods for enclosed applications.

1.7 WARRANTY

.1 Contractor hereby warrants that the water-proofing membrane will stay in place and remain leakproof for two years from the date of completion certificate.

.2 Waterproofing membrane manufacturer hereby warrants that the waterproofing membrane will remain in a watertight condition and will not leak as a result of faulty materials for a period of five years. Scope of warranty shall include material required to return the membrane to a watertight condition.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Exterior waterproofing for vertical and horizontal applications shall consist of sheet membrane waterproofing of composite sheets comprised of rubberized asphalt integrally bonded to a film of high density cross laminated polyethylene, minimum 1.5 mm (60 mils) thick. The material shall be suitable for application at low temperature.
.1 Acceptable material: W.R. Grace Bituthene 3000, Bakor Blueskin WP200, or approved equivalent.

.2 Exterior joint sealant shall be a non-shrink, non-hardening butyl rubber sealant.

2.1 MATERIALS (Cont'd)

.2 (Cont'd)
.1 Acceptable material: Conseal CS-202 or approved equivalent.

.3 Exterior joint wrap shall be a non-shrink, non-hardening polyolefil back 300 mm wide joint wrap.
.1 Acceptable material: Conseal CS-212 or approved equivalent.

.4 Primer: as recommended by the waterproofing manufacturer.

.5 Mastic and tapes: as recommended by membrane manufacturer.

.6 Fillet T-joint sealant: as recommended by membrane manufacturer.

.7 Adhesives: as recommended by membrane manufacturer.

.8 Liquid membrane for detailing: as recommended by membrane manufacturer.

2.2 COMPATIBILITY

.1 Ensure that all materials used are compatible.

.2 Provide proof of compatibility.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install materials only in suitable weather, when there is no threat of precipitation, and in accordance with manufacturer's instructions.

3.2 PREPARATION

.1 Prime all surfaces to receive membrane waterproofing by means of roller or spray at a rate recommended by the manufacturer.

.2 Allow primer to dry adequately before proceeding with membrane. Avoid puddles.

3.2 PREPARATION (Cont'd)

.3 Treat only as much area as can be covered with membrane the same day. Primed surfaces not covered by waterproofing membrane during the same working day must be reprimed.

.4 Metal surfaces must be free of grease, oil dirt, loose paint, rust or other contaminants.

.5 Concrete surfaces shall be smooth, clean, dry and free of foreign matter.

3.3 APPLICATION

.1 Do waterproofing work in accordance with membrane manufacturers printed application instructions.

.2 Apply membrane fully adhered to surfaces as indicated.

.3 Lap membrane joints minimum 300mm. Roll all seams continuously.

.4 Install reinforcing strip of membrane waterproofing over all outside corners. Install reinforcing strips prior to field membrane application.

.5 Centre reinforcing strip of membrane waterproofing over non-working joints and cracks up to a maximum of 5 mm. Width of reinforcing strip as recommended by manufacturer.

.6 Notify Engineer of non-working joints over 5 mm and treat as directed.

.7 Apply liquid mastic to horizontal and vertical terminations.

.8 Seal daily terminations with mastic.

.9 Seal penetrations through membrane with liquid membrane and sheet membrane as recommended by manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Roadway Construction: Section 31 24 13.

1.2 REFERENCES

.1 ASTM International
.1 ASTM B 209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate Metric.
.2 ASTM A123-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 Canadian General Standards Board (CGSB)
.1 CGSB 62-GP-11M-AMEND, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing and Amendment.

.3 CSA International
.1 CSA G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 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 traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Indicate items as follows:
.1 Sign message, dimensions, materials, erection details and methods of attachment for each sign.

1.4 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Sign supports:

.1 50mm x 50mm square, shaped, perforated, 3 mm wall thickness, hot dip galvanized to ASTM A123, minimum 600 g/m^2 coating. Length as required. Provide 60 mm square tubing sleeve, 1,000 mm long to CSA G40.20.

.2 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

.3 Security bands and brackets for attaching signs to aluminum street lighting poles or wood utility poles shall be "Band-it" brand, or approved equal.

.2 Signboards:

.1 Aluminum sheet: to ASTM B 209M, precut to required dimensions.

.1 Thickness for signboards up to 750 mm wide: 16 gauge.

.2 Thickness for signboards 750-1200 mm wide: 12 gauge.

.2 Xylene thinner: to CAN/CGSB-1.94.

.3 Primer for aluminum: to CAN/CGSB-1.132.

.4 Reflective sheeting and tape: to CGSB 62-GP-11M. Adhesive, class of reflectivity and colour as indicated. Acceptable Product: Scotchlite High Intensity Prismatic Grade 3930 Series as manufactured by 3M.

.5 Transparent tape: flexible, smooth-surfaced, moisture resistant tape with pressure sensitive adhesive.

2.2 FABRICATION

.1 Signboards:

.1 Aluminum blanks:

.1 Degrease, etch and bonderize with chemical conversion coating.

.2 Clean surfaces with xylene thinner. Dry.

.3 For non-reflective signs, spray face with one coat vinyl pretreatment coating and two finish coats of required colour.

.4 For aluminum signboards that are to be painted before installation, spray and bake face of signboards with two coats of enamel in accordance with CAN/CGSB-1.104.

.2 Reflective background sheeting and lettering:

2.2 FABRICATION (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.1 Cut and apply in accordance with manufacturer's instructions.

.2 Apply adhesive coated material with heat lamp vacuum applicator or by squeeze roll application method. Apply pressure sensitive material with roller or squeegee.

.3 Reflective signboard faces may be prepared using silk screen transparent ink.

.3 Clean signboards completely and apply transparent tape over top edge and extending 25 mm minimum down back and front of signboard.

.4 Protect finished signboard faces with one coat of clear varnish.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Sign support:

.1 Excavate post hole to depth required.

.2 Place and plumb sleeve in center of excavation. Backfill around sleeve.

.3 Install sign post in sleeve and anchor in place with galvanized bolts, nuts and washers.

.2 Signboard:

.1 Fasten signboards to supporting posts and brackets as indicated. Attach signs to street lighting and flashing beacon poles with approved stainless steel brackets and bands.

3.2 CORRECTING DEFECTS

.1 Correct defects, identified by Consultant, in sign message, consistency of reflectivity, colour or illumination. Correct angle of signboard and adjust luminaire aiming angle for optimum performance during night conditions to approval of Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 General Instructions: Section 01 10 10

.2 Submittal Procedures: Section 01 33 00

.3 Closeout Submittals: Section 01 78 00

.4 Cast-in-place Concrete: Section 03 30 00

.5 Electrical: Division 26

.6 Submersible Pumping Station: Section 33 32 14

1.2 REFERENCE STANDARDS

.1 ASTM D256-2010, Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

.2 ASTM D618-2008, Standard Practice for Conditioning Plastics for Testing.

.3 ASTM D638-2010, Standard Test Method for Tensile Properties of Plastics.

.4 ASTM D732-2010, Standard Test Method for Shear Strength Plastics by Punch Tool.

.5 ASTM D790-2010, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.6 ASTM D792-2008, Standard Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

.7 ASTM D2583-2013, Standard Test Method for Indentation Harness of Rigid Plastics by Means of a Barcol Impressor.

1.3 SUBMITTALS

.1 Submit shop drawings for enclosure in accordance with Section 01 33 00. Drawings shall include all critical dimensions and locations of all accessories that are part of the enclosure.

1.4 CLOSEOUT SUBMITTALS

.1 Submit manufacturer's Installation Instruction for all components for inclusion in Operation and Maintenance Manuals in accordance with Section 01 78 00.

.2 Submit manufacturer's latest operation and/or maintenance procedures for inclusion in Operations and Maintenance Manuals in accordance with Section 01 78 00.

.3 Submit manufacturer's warranty.

1.5 STRUCTURAL DESIGN

.1 Anchor enclosure to concrete foundation.

.2 Design enclosure to withstand wind and snow loads for the geographical region.

.3 Design anchorage system to distribute loading equally between designated anchoring points on enclosure.

1.6 WARRANTY

.1 Standard warranty shall be twenty-four (24) months from the Owner's acceptance.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

.1 General construction: provide enclosure with a smooth interor and sided exterior finish as per City of Summerside Standard. Walls and roof must be integral with smooth radii for all corners. Enclosure shall have two (2) separate sections, mechanical and electrical.

.2 In addition the enclosure will have a metal roof. Vic West or approved equal.

2.1 CONSTRUCTION (Cont'd)

.3 Laminate: isophthalic polyester resin with high performance, chopped, commercial grade glass strand fiber reinforcement with a suitable coupling agent.

.1 Minimum glass content: 30%.

.2 Exterior surface: 15mil (minimum) gel coat with U.V. inhibitors, flame inhibitors and a satain finish lightly textured and free from fiber pattern, roughness or other irregularites.

.3 Exterior laminate: 3mm thick (minimum); chemically bonded to the surface gel coat and encapsulating the foam core.

.4 Foam core 89mm thick, minimum insulation value of R-12.

.5 Interior laminate: 3mm thick (minimum); chemically bonded to the interior gel coat and encapsulating the foam core.

.6 Interior surface: 15mil (minimum) gel coat with U.V. inhibitors, flame inhibitors and a textured finish, free from exposed glass and other irregularities.

.7 Laminate properties:

.1 Tensile strength (ASTM D638): 14,000 psi.

.2 Flexural strength (ASTM D790): 27,000 psi.

.3 Flexural modulus (ASTM D790): 1,000,000 psi.

.4 Shear strength (ASTM D732): 12,000 psi.

.5 Barcol hardness (ASTM D2583): 40.

.6 Density/specific gravity (ASTM D632): 93.6pcf/1.5.

.8 Colour to be selected by Owner from colour chart.

.4 The manufacturer must maintain a continuous quality control program and upon request furnish to the Engineer certified test results of the physical properties.

2.2 ACCESSORIES

.1 Door hardware to be galvanized or stainless steel.

.2 Embedded metal wear plates in thresholds for top and bottom door latches.

2.2 ACCESSORIES (Cont'd)

.3 Door gaskets to be a full rubber gasket.

.4 Partition wall to be fully laminated into the interior of the enclosure and suitable for an equipment mounting structure.

2.3 ACCEPTABLE PRODUCT

.1 Dura-Tech, ZCL Composites, RPS Coomposites, Denyg, or approved equivalent.

PART 3 - EXECUTION

3.1 ASSEMBLY

.1 Handle and install enclosure and material in strict accordance with manufacturer's written instructions. Ensure instructions are issued at the time of shop drawing issue and are available on site.

.2 Take necessary field measurements to ensure accurate and proper fitting of work and equipment supplied. Ensure access hatch covers and enclosure doors can be open at the same time.

.3 Provide temporary supports, hoists and bracing to prevent overloading of structure during installation.

.4 Provide correct type and full number, size and length of stainless steel anchor bolts and other stainless steel connecting bolts as required by manufacturer. Preset anchor bolts in concrete where convenient otherwise use approved chemical anchoring system.

.5 Coordinate location and provide items for embedding into cast-in-place concrete.

.6 Provide sealing between enclosure and concrete, including partition wall.

3.2 HANDLING

.1 Do not drop or impact enclosure or sections of enclosure.

3.2 HANDLING (Cont'd)

.2 Use installation lift lug(s) to lift enclosure where applicable. Guide the enclosure with guidelines. Do not use chains or cables around enclosure.

.3 Check capacity of lifting equipment before handling.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 This section is to be read in conjunction with and covers items common to all sections of Division 23. It is intended to supplement the requirements of Sections 01 10 10 and 01 78 00.

.2 Specification sections referred to within this section are as follows:
.1 Concrete: Section 03 30 00
.2 Metal Fabrications: Section 05 50 00
.3 FRP Equipment Enclosure: Section 13 34 23.
.4 Submersible Pumping Station: Section 33 31 00

1.2 GENERAL

.1 Perform the Work included in these specifications and any accompanying drawings, by providing all supervision, labour, materials, supplies, construction tools, equipment and services, hoisting, transportation, receiving, handling, storage, and all other services and expenditures; unless otherwise specified in the scope. Including those not specifically mentioned but which are necessary for a complete installation.

1.3 EQUIPMENT

.1 Equipment assemblies comprised of electro-mechanical components shall be CSA approved where possible and shall bear the appropriate label. If the equipment in question is not CSA approved as an assembly, the manufacturer will arrange and pay for spot approval and labelling of the equipment prior to installation.

1.4 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping and duct systems without interfering with other equipment.

1.4 EQUIPMENT INSTALLATION (Cont'd)

.2 Provide means of access for servicing equipment including permanently lubricated lifetime bearings.

.3 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.5 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by others.

1.6 TRIAL USAGE

.1 The Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.7 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.8 ELECTRICAL

.1 Electrical Work and electrical equipment:
.1 Refer to drawings to determine mechanical/electrical wiring responsibilities.

1.9 MOTORS

.1 Provide motors for mechanical equipment as specified and as indicated.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install alternative motor approved by the Consultant for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motor frames to be either of rigid fabricated steel or castings.

.4 All studs, nuts and bolts subject to periodic removal maintenance purposes shall have Unified or American Standard Threads.

1.9 MOTORS (Cont'd)

.5 Specific requirements:
.1 Single phase motors: provide single phase motors of the capacitor start or two-valve capacitor type.

1.10 TESTS

.1 Give 24 hour written notice of date for tests.

.2 Insulate or conceal work only after testing and approval by the Consultant.

.3 Conduct tests in presence of the Consultant.

.4 Bear costs including retesting and making good.

.5 Piping:
.1 General: maintain test pressure without loss for 2 hours unless otherwise specified.

.6 Equipment: test as specified in relevant sections.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.11 SPARE PARTS

.1 Furnish spare parts as follows:
.1 Thermostat and control components (including cabinets) keys.
.2 And as specified elsewhere

1.12 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 33 00.

1.13 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork, fans and air handling systems.

.2 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition.

1.14 DRAWINGS

.1 The Consultant's drawings:
.1 Are not intended to show structural details or architectural features.
.2 Are not to be scaled.
.3 Except were dimensioned, indicate general mechanical layouts only. Because of the small scale of the Mechanical Drawings, it is not possible to show all offsets, fittings and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves and accessories which are required to meet site conditions.

.2 Provide field drawings to indicate relative position of various services when required by the Consultant.

1.15 RECORD DRAWINGS

.1 Refer to Section 01 78 00.

1.16 WARRANTIES

.1 Make good all defects other than normal wear and tear during the life of the warranty period. Warrant all Work and installed equipment to work quietly and satisfactorily and to accomplish the work for which it was installed during the life of the warranty. At any time during this period, make any necessary changes and adjustments, or replacements, to accomplish this at no additional cost to the project.

1.17 PERMITS AND REGULATIONS

.1 Comply with all regulations and authorities having jurisdiction where applicable, including but not limited to the following:
.1 Department of Labour.
.2 Fire Marshall.
.3 Plumbing Inspector.
.4 Provincial Board of Insurance Under-writers.
.5 National Building Code.
.6 Occupational Health & Safety Act.
.7 NFPA

.2 Obtain and pay for any permits required by local codes and regulations and arrange for inspections applicable to the Contractor responsibilities.

.3 Any additional materials or labour required to conform to any of these rules and regulations will be furnished under the Contract with no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASME B40.100-2005, Gauges-Pressure, Indicating Dial Type-Elastic Element.

.2 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

.3 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 00.

.2 Submit manufacturer's product data for following items:
.1 Thermostats.
.2 Air flow switches.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 01 10 00.

PART 2 - PRODUCTS

2.1 EXPLOSION-PROOF LINE VOLTAGE THERMOSTATS

.1 Heavy duty line voltage thermostats complete with explosion proof housing capacity to 22 amps at 120 VAC.

.2 Acceptable Material: Honeywell T6051B or approved equivalent.

2.2 LINE VOLTAGE THERMOSTATES

.1 Heavy duty line voltage thermostats to 22 amps at 120 VAC.

.2 Acceptable material: Honeywell T6051A or approved equivalent.

2.3 FLOW SWITCHES

.1 Differential pressure switches shall be installed across the supply fans where indicated on the Drawings. Switches shall be set to trip when air flow drops below specified flow rate.

.2 Switches to be explosion proof.

.3 Acceptable material: Dwyer Series 1950, or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install thermostats so they can be easily adjusted from floor.

.2 Install flow switches with stainless steel tubing in locations indicated on drawings.

.3 Flow switches to be wired to RTU terminals by Division 26.

3.2 THERMOMETERS

.1 Install in locations as indicated.

3.3 PRESSURE SWITCHES

.1 Install in locations as indicated:

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This section applies to operating dampers not specified in under the Controls scope of work.

1.2 PRODUCT DATA

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

.2 Indicate the following:
.1 Performance data.
.2 Construction, size and location.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

PART 2 - PRODUCTS

2.1 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted or counterweighted, as required for positive closure.

.2 Acceptable product: Tamco Series 7000, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

3.1 INSTALLATION (Cont'd)

.3 Seal multiple damper modules with silicon sealant.

.4 Upon system start-up, ensure that dampers operate through full angular range and seal tightly in their closed position.

.5 Caulk airtight between duct and damper frame for tight close-off.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 AMCA 99-2010, Standards Handbook.

.2 ANSI/AMCA 210-2007, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 AMCA 300-2007, Reverberant Room Method for Sound Testing of Fans.

.4 AMCA 301-2007, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.5 ANSI/ASHRAE 51-2007, Laboratory Methods of Testing Fans for Rating.

.6 ABMA 9-2008, Load Rating and Fatigue Life for Ball Bearings.

.7 ABMA 11-2008, Load Rating and Fatigue Life for Roller Bearings.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 00.

.2 Product data to include fan curves and sound rating data.

.3 Indicate following: motors, wheels, bearings, dimensions, weight, sound power levels and drives for all roof and wall exhausters.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 10 00.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

1.4 CERTIFICATION OF RATINGS (Cont'd)

.2 Provide confirmation of testing.

PART 2 - PRODUCTS

2.1 FANS GENERAL

.1 Capacity, static pressure, fan and motor RPM, hp, model and size as indicated in the schedule.

.2 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.3 Statically and dynamically balanced. Constructed in conformity with AMCA 99.

.4 Ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51.

.5 Bearings: ball bearings of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 h. Bearings to be rated and selected in accordance with ABMA9 and ABMA 11.

.6 Accessories and hardware: matched sets of V-belt drives, adjustable motor bases, belt guards, fan inlet and outlet safety screens, as indicated.

.7 Acceptable product: Loren Cook ACWD Series, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install curbs in accordance with roofing manufacturers recommendations to ensure a weather-tight fit.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM E90-2009, Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 ANSI/ASHRAE 51-2007, Laboratory Method of Testing Fans for Rating.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 10 00.

.2 Indicate fabrication and erection details, including anchorage, accessories, and finishes.

1.3 MAINTENANCE DATA

.1 Provide operation and maintenance data for maintenance of manually operated louvres for incorporation into manual specified in Section 01 78 00.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by them from independent testing agency signifying adherence to codes and standards.

1.5 TEST REPORTS

.1 Submit certified data from index laboratory substantiating acoustic aerodynamic performance to ASTM E90.

PART 2 - PRODUCTS

2.1 STATIONARY LOUVRES

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

2.1 STATIONARY LOUVRES (Cont'd)

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1.5m between supports.

.4 Frame, head, sill and jamb: 150mm deep one piece extruded aluminum, minimum 2.657mm (12 ga.) thick with approved caulking slot, integral to unit and sill extension as indicated. Sill drain piped to outside.

.5 Mullions: at 1500mm maximum centres.

.6 Fastenings: stainless steel SAW-194-8F with SAW-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12mm x 12mm openings, 2mm dia. wire aluminum birdscreen on inside face of louvres in formed U-frame. (Removable.)

.8 Finish: factory applied prime coat finish. G.C. shall apply finish coat of paint (color by the Consultant).

.9 Acceptable Material: Ruskin; E.H. Price; Construction Specialties; Airolite Type K6776; TA Morrison; Alumavent; Penn Canada; M.W. McGill.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install to the sizes and where indicated in accordance with manufacturer's recommendations and in accordance with recommendations of SMACNA.

.2 Reinforce and brace air vents, intakes and gooseneck hoods for wind speed in accordance with NBC for location.

.3 Caulk around entire perimeter using a waterproof, non-hardening mastic sealant.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

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

.2 Submit product data sheets for unit heaters. Include:
- .1 Product characteristics.
- .2 Performance criteria.
- .3 Mounting methods.
- .4 Physical size.
- .5 kW rating, voltage, phase.
- .6 Cabinet material thicknesses.
- .7 Limitations.
- .8 Colour and finish.

.3 Submit product data sheets for unit heaters. Include product characteristics, performance criteria, physical size, limitations and finish.

1.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 10 00.

PART 2 - PRODUCTS

2.1 UNIT HEATER - CONVECTION

.1 Electric unit heater to be horizontal, convection type of 1kW rating. Voltage and phase as specified on the drawings.

.2 Heating elements: tubular heating element with fins.

.3 Cabinet: die formed, steel, 18 gauge, complete with louvers.

.4 Unit heater shall be complete with heavy duty, mounting bracket suitable for wall mounting as indicated on the drawings.

.5 Finish: Polyester, epoxy powder coat paint finish, almond colour.

2.1 UNIT HEATER - CONVECTION (Cont'd)

.6 Unit heater to be complete with the following controls and accessories:
.1 Automatic reset overtemperature protection.
.2 Terminal blocks for all field wiring.
.3 Integrated thermostat.

.7 Heaters to be suitable for installation in a Class 1, Zone 2 hazardous area.

.8 Unit heater to be suitable for operation by thermostat as noted on the drawings.

.9 Standard of Acceptance:
.1 Ouellet OPX Series (Temperature Code T3A).

.10 Additional acceptable manufacturers:
.1 Chromalox
.2 Q-Mark
.3 Stelpro
.4 CCI Thermal

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install all electric heaters and controls as indicated and in accordance with manufacturer's instructions.

.2 Power and control connections shall be by Division 26.

3.2 FIELD QUALITY CONTROL

.1 Confirm that heaters and controls operate correctly.

END OF SECTION

1 WORK INCLUDED

.1 Provide all labour, tools, components and equipment necessary to complete the electrical and instrumentation systems for one sewage lift station.

.1 Provide three phase power service to the Station site, carry out all negotiations with Summerside Electric for power supply and connection and pay all charges in connection therewith.

.2 Supply and installation of a new duplex pump controller.

.3 Supply and installation of a new submersible level transmitter, including signal wiring.

.4 Supply and installation of a new flowmeter, including signal wiring.

.5 Supply and install general electrical equipment as indicated on the drawings.

.6 Supply and installation of power, control, and instrumentation wiring to and from the pump control panel.

.7 Provide and install all grounding necessary to satisfy the Canadian Electrical Code - Part I and the local Provincial Inspection Authority.

.8 Provide all hardware, software and programming required to integrate into the City's existing monitoring system.

.9 Document, test and calibrate to the satisfaction of the Engineer all electrical and instrumentation equipment as specified herein and on the drawings.

.10 Be responsible for the safe storage on site of all electrical equipment awaiting installation.

.11 The Contractor shall be responsible for the protection during construction of all installed electrical equipment.

.12 Equipment damaged during construction, or otherwise deemed defective or non-compliant with this specification, must be repaired/replaced by the Contractor at no expense to the Owner. These expenses will include all material, labour and other fees.

.13 Obtain any "scope of work" clarification prior to issuing their Tender. Any cost extras due to any misunderstanding/misinterpretation of the scope of Work will not be entertained during the construction phase of the Work.

1 WORK INCLUDED (Cont'd)

.1 (Cont'd)

.14 Some areas will be considered as hazardous locations. All electrical installations in these areas shall be in accordance with the Canadian Electrical Code for the specified classification. These areas contain hydrogen sulphide (North American Gas Group C, IEC Gas Group IIB) and methane (North American Gas Group D, IEC Gas Group IIA) gases. These areas are also a Category 2 location in accordance with Section 22 of the Canadian Electrical Code and the electrical installation will be completed as per the requirements of a Category 2 location.

.15 Coordinate and schedule with other trades to ensure that the construction proceeds in a timely and efficient manner.

.16 Coordinate with the Owner, control supplier, pump supplier and power authority having jurisdiction for proper set-up of pump controller and equipment.

.17 Coordinate and be responsible for the disconnection, abandonment, and removal of all electrical equipment from the existing lift station.

2 REFERENCES

.1 CSA C22.1-18, Canadian Electrical Code, Part I (24st Edition), Safety Standard for Electrical Installations.

.2 CSA C22.3 No.1:20, Overhead Systems.

.3 CSA C22.3 No.7:20, Underground Systems.

.4 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50 000 V.

3 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1, Canadian Electrical Code, Part I (21st Edition), Safety Standard for Electrical Installations, except where specified otherwise.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50 000V.

3 CODES AND STANDARDS (Cont'd)

.3 Do overhead and underground systems in accordance with CSA C22.3 No.1, Overhead Systems and C22.3 No.7:20, Underground Systems except where specified otherwise.

4 PERMITS, FEES AND INSPECTIONS

.1 The Contractor shall submit to the Electrical Inspection Department, and Supply Authority the necessary number of drawings and specifications, for examination and approval prior to commencement of work.

.2 Obtain all necessary permits including an Electrical Wiring Permit for electrical work and Communications Cabling Permit for communications cabling Work from the authority having jurisdiction, prior to commencement of Work. Provide a copy of each permit to the Engineer upon receipt. Display permits properly on the Work site.

.3 Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Engineer immediately upon receipt. Notify the Engineer immediately of changes required by the authority having jurisdiction, prior to making changes.

.4 Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of work. Include a copy in the Operation and Maintenance Manual.

.5 Pay all associated fees.

5 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 Submit shop drawings, product data and samples in accordance with Section 01 33 00.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams.

.4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

6 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manual in in accordance with Section 01 78 00.

.2 Include in operations and maintenance data:
.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
.3 Wiring and schematic diagrams and performance curves.
.4 Names and addresses of local suppliers for items included in maintenance manuals.
.5 Copy of reviewed shop drawings.

7 CARE, OPERATION AND START-UP

.1 Instruct operating personnel in the operation, care and maintenance of equipment.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Except where note otherwise, provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

8 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235.

.2 Motors, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

9 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 10 10.

.2 Equipment and material to be CSA certified or certified by an agency recognized by the Electrical Inspection Department.

.3 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval, in writing, from Electrical Inspection Department.

.4 Factory assemble control panels and component assemblies.

.5 Use stainless steel fasteners throughout for all conduits, cables and equipment. Fasteners include nuts, bolts, screws and washers.

10 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Control wiring is specified in Section 26 05 21.

.2 Supplier and installer responsibility must be coordinated by the Contractor to achieve a complete functioning system.

11 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.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.

12 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

12 EQUIPMENT IDENTIFICATION (Cont'd)

.2 (Cont'd)

.1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached unless specified otherwise.

NAMEPLATE SIZES

Size 1	9 x 50 mm	1 line	3 mm	high letters
Size 2	12 x 70 mm	1 line	5 mm	high letters
Size 3	12 x 70 mm	2 lines	3 mm	high letters
Size 4	19 x 90 mm	1 line	9 mm	high letters
Size 5	19 x 90 mm	2 lines	5 mm	high letters
Size 6	25 x 100 mm	1 line	12 mm	high letters
Size 7	25 x 100 mm	2 lines	6 mm	high letters

.3 Wording on nameplates to be approved by Engineer prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Provide clearly visible markings on electrical equipment to warn persons of potential electrical shock and arc flash hazards as specified in Section 2 of the Canadian Electrical Code.

.8 Junction boxes, panels and miscellaneous wire ways containing intrinsically safe circuits shall be provided with a warning nameplate prominently displayed: "Intrinsically Safe Circuit".

13 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, 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.

13 WIRING IDENTIFICATION (Cont'd)

.3 Colour code: to CSA C22.1.

14 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

15 MANUFACTURERS' AND CSA LABELS

.1 Visible and legible after equipment is installed.

16 WARNING SIGNS

.1 Provide warning signs as specified and to meet requirements of Electrical Inspection Department.

.2 Porcelain enamel signs, minimum 180 x 250 mm.

17 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not indicated verify before proceeding with installation.

.3 Install electrical equipment at the following heights unless indicated otherwise.
.1 Panelboards: as required by the code or as indicated.

18 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

19 LOAD BALANCE

.1 Measure phase current to 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.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

20 TESTS

.1 Conduct and pay for tests of the following:
.1 Power distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors and associated control equipment including sequenced operation of systems where applicable.

.2 Furnish manufacturer's, certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturers instructions.

.3 Carry out tests in presence of Engineer. Provide five (5) days notice of such tests.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Submit test results for Engineer's review and approval.

.6 Insulation Resistance Testing:
.1 Megger circuits, feeders and equipment up to 350 V with 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.

21 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Obtain motor data from the equipment supplier.

22 CLEANING

.1 Do final cleaning in accordance with Section 01 10 00.

.2 Clean the interior of all cabinets and control equipment.

.3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

23 QUALITY ASSURANCE

.1 Instructions:
.1 Interferences: electrical drawings are generally of a diagrammatic nature. Plan and coordinate the Work to eliminate interferences with other trades. Provide all necessary raceway offsets, fittings, and boxes, adjust all equipment boxes, adjust all equipment locations and provide all supporting materials required for a planned, coordinated and neat installation. Where interferences occur, the Engineer's authorized representative will decide which item must be relocated regardless of which was installed first.
.2 Electrical workmanship: provide workmanship of the highest quality. Sub-standard Work will not be accepted. Use only persons skilled in the trades involved.
.3 Electrical materials: provide all materials used in this work, unless particularly specified otherwise, that are new, free from flaws, or imperfections.
.4 Sleeves and inserts: furnish and locate all sleeves and inserts required for this work in accordance with drawings.

.2 Applicable standards:

23 QUALITY ASSURANCE (Cont'd)

.2 (Cont'd)

.1 Electrical Work to conform with the requirements and recommendations of the latest edition of the Canadian Electrical Code and all local codes and ordinances. In conflicts between codes, the more stringent requirements will govern.

.2 In no instance will the standard established by this specification be reduced by any of the codes or standards referred to in this specification.

.3 Standards: the specifications and standards of the following organizations are by reference made as part of these specifications and all electrical Work, unless otherwise indicated, must comply with their requirements and recommendations wherever applicable.

.4 Canadian Standard Association (CSA).

.5 Institute of Electrical and Electronics Engineers (I.E.E.E.).

.6 Instrument Society of America (I.S.A.).

.7 American Society for Testing Materials (A.S.T.M.).

.8 Insulated Power Cable Consultants Association (I.P.C.E.A.).

.9 Electrical Equipment Manufacturer's Association of Canada (E.E.M.A.C.).

.10 National Fire Protection Association (N.F.P.A.).

.11 Underwriter's Laboratories of Canada (U.L.C.).

.12 All local and provincial codes and ordinances.

24 RECORD DRAWINGS

.1 Record Drawings:

.1 After award of Contract, Engineer will provide a set of full-size drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Engineer.

.2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Engineer.

.3 On completion of Work and prior to final inspection, submit record documents to Engineer.

24 RECORD DRAWINGS (Cont'd)

.1 (Cont'd)

.4 Refer to Section 01 10 10 for more details.

25 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all debris and waste materials at appropriate disposal/recycling facilities.

.2 Separate and recycle waste materials in accordance with applicable Construction/Demolition Waste Management and Disposal Regulations.

.3 Refer to Section 01 10 10 for additional requirements for disposal and recycling.

END OF SECTION

1.1 WORK INCLUDED IN CONTRACT

.1 Power service to sectionalizing cabinets and padmount transformers as indicated.

.2 Installation of fiberglass sectionalizing cabinet and transformer pads as indicated. (Sectionalizing cabinet to be supplied by Maritime Electric).

.3 Supply and installation of power and communications conduits as indicated.

.4 Supply and installation of secondary splice boxes as indicated.

.5 Supply and installation of precast concrete power and communication manholes as indicated.

.6 Supply and installation of communications grade level boxes as indicated. (Pedestals mounted on the boxes supplied by Bell Aliant).

.7 Supply and installation of secondary power conductors as indicated.

.8 Supply and installation of street lighting power and control equipment and precast concrete light pole bases as indicated.

.9 Installation of street lighting poles and light fixtures.

1.2 CODES AND STANDARDS

.1 Complete installation in accordance with CSA C22.1-2010, CSA C22.3 No.1, and C22.3 No.7:20, except where specified otherwise.

.2 Comply with CSA Electrical Bulletins in force at time of tender submission, while not identified and specified by number in this Division, are to be considered as forming part of related CSA Part II standard.

.3 Abbreviations for electrical terms: to CSA Z85-1963.

.4 Work to be to approval and standard of Maritime Electric, Bell Aliant and Eastlink.

1.3 PERMITS, FEES

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specification for examination and approval prior to commencement of work.

.2 The electrical contractor to pay the utilities fees. Allow for an amount of $30,000 in bid price for the electrical communication utilities fees. Credits/extras will be processed when the exact amount of the utilities fees is known. A copy of the final detailed utilities fees shall be provided to the Consultant.

1.4 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 Submit shop drawings, product data and samples in accordance with Section 01 33 00.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams, and operating manuals.

.4 Include wiring drawings or diagrams showing interconnection with work of others.

1.5 INSPECTION

.1 Advise Consultant so that he may inspect conduits before they are backfilled.

.2 Furnish a Certificate of Acceptance from the Electrical Inspection Department on completion of work.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Sections 26 05 10 and 26 56 19. Also provide five copies of a manual of operation and maintenance including details of proprietary equipment.

1.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying number, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Color code wiring to CSA C22.1-2009.

.4 Provide identification labels meeting the requirements of Maritime Electric on all secondary conductors to be connected to the padmounted transformers.

1.8 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring must be suitable for either copper or aluminum conductors.

1.9 MANUFACTURERS AND CSA LABELS

.1 Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

1.10 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark all live parts "LIVE 600 VOLTS", or with appropriate voltage.

1.11 CONDUIT AND CABLE INSTALLATION

.1 Install cables, conduits, and fittings, as indicated on the drawings.

.2 Install 6 mm nylon pull ropes in all empty conduits.

.3 Coordinate work with Maritime Electric, Bell Aliant and Eastlink as necessary.

1.12 INSULATION RESISTANCE TESTING

.1 Megger circuits, feeders and equipment up to 350V with a 500V instrument and 600V circuits with 1000V instrument.

.2 Check resistance to ground before energizing.

1.13 CLEANING

.1 Do cleaning in accordance with Section 01 10 00.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 Furnish and install type DB2 duct and PVC conduit bends underground and PVC conduit above grade as indicated on drawings.

.2 Install fiberglass sectionalizing cabinet supplied by Maritime Electric as indicated on the drawings.

.3 Furnish and install transformer pads, pull boxes, secondary splice boxes and conductors as indicated on the drawings.

.4 Furnish and install telephone/TV boxes as indicated on the drawings.

.5 Furnish and install street lighting power, control equipment, bases, poles and light fixtures as indicated.

.6 All materials, accessories and any other equipment necessary for the complete and proper installation of the conduit systems, conductors, sectionalizing cabinets, transformer pads, secondary splice boxes, telephone/TV, boxes as indicated on the drawings shall be furnished by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Copper and aluminium conductors: to CSA C22.2 No. 38-2018

.2 Grounding equipment: to CSA C22.2 No. 41-2017.

.3 Copper and aluminum grounding conductors: to ASA G7.1-1964.

2.2 CONDUCTORS

.1 Conductors from padmount transformers to pencell secondary splice boxes to be aluminum NU-AL RW90, 600 volt rated. Conductors from padmount transformers to street lighting service equipment and branch circuits to be copper RW90 600V rated.

2.3 CONDUITS

.1 DB2 duct and rigid PVC conduit, sized as indicated.

2.4 CONDUIT FITTINGS

.1 Fittings manufactured for use with conduit specified.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

2.5 FASTENERS

.1 All fasteners used outdoors including nuts, bolts, washers, screws and mounting hardware such as conduit straps and brackets shall be stainless steel.

2.6 EXPANSION FITTINGS FOR RIGID PVC CONDUIT

.1 Provide watertight expansion fittings in PVC conduits as indicated on drawings.

2.7 GROUNDING EQUIPMENT

.1 Provide ground electrodes and grounding conductors as indicated on drawings.

.2 Provide insulated bonding conductors, green in colour, as indicated between ground lugs of electrical equipment and panelboards and ground bars in light poles and pole enclosures.

2.8 TELEPHONE/TV PEDESTALS AND GRADE LEVEL BOXES

.1 Bell Aliant approved grade level boxes manufactured by Channell and distributed by Anixter.

2.8 TELEPHONE/TV PEDESTALS AND GRADE LEVEL BOXES (Cont'd)

.1 (Cont'd)
.1 Grade level thermoplastic box, 24" x 36" x 24" with 8,000 lb load rating on lid, Channell part #SGLB2436241T220A04, material code 390300.
.2 Pedestals mounted on the boxes will be supplied and installed by Bell Aliant.

.2 19 mm x 3 metre ground rod or approved ground plate for each unit to be provided and installed by electrical contractor.

2.9 FIBERGLASS TRANSFORMER PADS

.1 Fiberglass transformer pads, manufactured by Nordic Fiberglass Inc. or equal meeting the requirements of Maritime Electric.

2.10 SECONDARY SPLICE BOXES

.1 Pencell Series AGLPNS-183218, manufactured by Pencell Plastics (Hubbell). Confirm new Hubbell part number when ordering.

PART 3 - EXECUTION

3.1 INSTALLATION OF SECTIONALIZING CABINETS, TRANSFORMER PADS AND SECONDARY SPLICE BOXES

.1 Install sectionalizing cabinets, transformer pads, and secondary splice boxes as indicated on drawings.

3.2 INSTALLATION OF TELEPHONE/TV GRADE LEVEL BOXES

.1 Install telephone/TV grade level boxes as indicated on drawings and in accordance with Bell Aliant requirements.

3.3 INSTALLATION OF STREET LIGHTING SERIVCES

.1 Install street lighting power services as indicated on drawings.

3.4 INSTALLATION OF DISTRIBUTION EQUIPMENT

.1 Install street lighting distribution equipment as indicated on the drawings.

3.5 INSTALLATION OF LIGHTING EQUIPMENT

.1 Install lighting equipment in accordance with Section 26 56 19 and as indicated on drawings.

3.6 INSTALLATION OF UNDERGROUND CONDUIT

.1 Install PVC conduits on terminal pole and type.

.2 Use PVC conduit to duct adapters when connecting duct to PVC conduit.

.3 Install conduits to cause minimum interference with other existing lines.

.4 Install warning tape above underground conduits as indicated, minimum 75 mm wide, marked "CAUTION - BURIED ELECTRICAL".

.5 Use cleaner and solvent cement at couplings as recommended by manufacturer.

.6 Install pressure treated planking 50 mm x 150 mm where indicated on drawings.

.7 Where conduits become blocked, remove and replace blocked section.

.8 Dry conduits out before installing wire.

3.7 SURFACE CONDUIT

.1 Fasten conduits to structures in a secure manner.

.2 Run parallel to structure lines.

.3 Install clamps on surface conduits to allow for expansion and contraction of the conduit.

3.8 INSTALLATION OF GROUNDING SYSTEM

.1 Install complete permanent, continuous, system including electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of Consultant, and local authority having jurisdiction over installation.

.2 Install connectors to manufacturers instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections to electrodes, using compressed type fittings, T & B or approved equal.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install grounding connections to distribution equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2 No. 0.3-09(R2019), Test Methods for Electrical Wires and Cables.

1.2 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 POWER WIRES

.1 Copper conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90-XLPE.

.3 Copper conductors: size as indicated, with 1000V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90-XLPE.

.4 Colour code wiring in accordance with the Canadian Electrical Code.

2.2 CONTROL WIRES

.1 Digital Circuits: minimum size: 14 AWG with 600 volt chemically cross-linked thermosetting polyethylene material rated RW90.

.2 Analog Circuits: minimum size: tinned stranded copper 16 AWG with individually twisted shielded pairs and 300 volt chemically cross-linked thermosetting polyethylene insulation, overall shield, overall PVC jacket.

2.2 CONTROL WIRES (Cont'd)

.3 PLC or RTU/Pump Controller Panel Wiring: all internal wiring to be Type RW90 or TEW. 120 VAC power and control wiring (phase and neutral) to be minimum #14 AWG. Digital signal wiring to be minimum #16 AWG. Analog wiring to be minimum #16 AWG. 120 VAC power supply wiring shall be black. All 120 VAC neutral wiring shall be white. All 120 VAC control wiring shall be red. All DC wiring shall be blue. All ground wiring shall be green. Stranded copper wiring shall be provided throughout. AC and DC wiring will be segregated and shall be installed on separate terminal strips.

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING WIRES AND CONTROL WIRES

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 IEEE 837-2014, Qualifying Permanent Connections Used in Substation Grounding.

1.2 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Direct buried grounding conductors: bare stranded copper, soft annealed, size as indicated.

.2 Insulated grounding and bonding conductors: stranded copper, soft annealed, size as indicated, green coloured insulation, type RW90.

.3 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.

.4 Rod electrodes, copper clad steel, 21mm diameter, 3m long.

.5 Clamps for grounding of conductor, size as required to grounding electrodes.

.6 Copper crimp type compression connectors (cable to cable, cable to ground rod).

.7 Copper crimp type compression connectors (long barrel, one or two hole as space permits).

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including conductors, connectors, accessories as indicated to conform to requirements of local authority having jurisdiction over installation. Where PVC conduit is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.7 Make buried connections, and connections to electrodes, using copper welding by thermit process or inspectable copper, crimp type and compression connectors.

.8 Provide an insulated copper bonding conductor in all conduit runs.

3.2 ELECTRODES

.1 Bond separate, multiple electrodes together.

.2 Use copper conductors, size as indicated, for connections to electrodes.

.3 Install grounding triad near the electrical service entrance and connect to electrical grounding system with copper conductor, size as indicated on the drawings.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 120/208 V and 347/600V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, pipe systems, frames of motors, starters, control panels and distribution panels.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.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 protection during tests.

PART 2 - PRODUCT

2.1 SUPPORT CHANNELS

.1 U shape, size 41 mm x 41 mm, 2.7 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings unless otherwise indicated.

.2 Standard rolled structural steel shapes and plates or prefabricated structural systems.

.3 Unless otherwise indicated, use hot dipped galvanized steel (after fabrication).

.4 Use stainless steel outside, in wet and corrosive areas and in hazardous areas.

2.2 CABLE TIES

.1 Nylon flame retardent, low smoke cable tie, size as required.

.2 Nylon flame retardant, low smoke cable tie mounting bracket. Mechanical fastening type only; adhesive mounts not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls with stainless steel toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

3.1 INSTALLATION (Cont'd)

.5 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole straps to secure surface conduits and cables 50 mm and smaller.
.2 Two-hole straps for conduits and cables larger than 50 mm.
.3 Conduit straps to match conduits in material and finish. Cable straps to be galvanized steel or stainless steel.

.6 For surface mounting of two or more conduits and cable, use support channels spaced in accordance with the Canadian Electrical Code (maximum 1.5m spacing).

.7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.8 Provide adequate support for conduits and cables dropped vertically to equipment where there is no wall support.

.9 Do not use wire lashing or perforated strap to support or secure conduits or cables.

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.11 Provide fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.

.12 Provide hot dipped galvanized or stainless steel beam clamps to secure conduits and cable tray to exposed steel work.

.13 Various suspended types of junction, pull and/or outlet boxes as well as conduits, are to be supported with minimum size 9 mm threaded rod, nuts and flat washers. Secure threaded rods to boxes with one (1) flat washer and nut installed on both sides of box.
.1 One (1) rod required for all type boxes sized 150 mm x 150 mm and smaller.

3.1 INSTALLATION (Cont'd)

.13 (Cont'd)

.2 Two (2) rods required for boxes sized 200 mm x 200 mm and larger, up to and including those sized 300 mm x 300 mm.

.3 Minimum of four (4) rods required for all boxes sized larger than 300 mm x 300 mm.

.4 Cut-off excess rod to within 12 mm of channel bottom.

.14 In addition to C.E.C. minimum conduit spacing requirements, all suspended conduit runs containing horizontal or vertical elbows are to have one additional support rod installed not greater than 300 mm and mid point of "all" 90° bends. Maximum spacings between conduit support channels will be dictated by smallest size conduit(s) being supported and/or secured to same.

.15 Where galvanized steel supports are exposed to moisture, touch-up all field cut surfaces with galvanizing paint.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

.1 All junction and pull boxes located in non-hazardous areas and outdoors shall be rated minimum NEMA 4X.

.2 All NEMA 4X junction and pull box external hardware shall be stainless steel.

.3 Junction and pull boxes shall be rated for the hazardous classification as noted on the drawings. Hazardous rated junction and pull boxes shall be die-cast copper free aluminum with factory threaded hubs and mounting feet for surface mounting.

.4 Provide terminal blocks (rated minimum 30A, 600V, quantity as required) in junction boxes used to connect the integral cabling from devices (float switches, pumps, etc.) located in the wet well.

2.2 SPLITTERS

.1 Splitter trough or box as indicated, size to suit application.

.2 Sheet metal enclosure (NEMA 12) with welded corners and formed hinged cover suitable for locking in closed position.

.3 Phenolic insulated splitter blocks with main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.4 At least three (3) spare terminals on each set of splitter blocks.

.5 Electrical ratings as indicated on drawings.

2.2 SPLITTERS (Cont'd)

.6 Splitter complete with ground bar.

.7 ANSI 61 gray polyester powder paint finish.

.8 Acceptable manufacturers: Bel, Eurobex, Ace, Hammond, Hoffman.

PART 3 - EXECUTION

3.1 JUNCTION AND PULL BOX INSTALLATION

.1 Install junction and pull boxes in inconspicuous but accessible locations.

.2 Mount junction and pull boxes as noted on the Drawings and as described in the specifications.

.3 Provide all required mounting hardware.

3.2 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to building lines.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Install size 2 identification labels.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.1-18, Canadian Electrical Code, Part 1, Latest Edition.

1.2 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Blank cover plates for boxes without wiring devices.

2.2 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

.2 PVC boxes where indicated and as required.

2.3 FITTINGS-GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

3.1 INSTALLATION (Cont'd)

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of opening in boxes for conduit and cable connections. Reducing washers not allowed.

END OF SECTION

PART 1 - GENERAL

1.1 LOCATION OF CONDUIT

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

1.2 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Rigid PVC conduit for underground services or as specified on the drawings.

.2 Liquid-tight flexible metal conduit.

.3 Rigid aluminum conduit.

2.2 CONDUIT FASTENINGS

.1 One hole cast aluminum straps to secure surface conduits 50 mm and smaller. Two hole cast aluminum straps for conduits larger than 50 mm.

.2 Stainless steel channel type supports for two or more conduits at 1.5 m oc. Use stainless steel "P" clamps to secure conduits to channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors for liquid tight flexible conduit.

.4 Raintight connectors for vertical connections to enclosures.

2.3 CONDUIT FITTINGS (Cont'd)

.5 Cast type EYS and EYD type sealing fittings with factory threaded hubs and rated for installation in the hazardous areas as noted on the drawings.

.1 Acceptable manufacturers: Appleton, Crouse-Hinds or Killark.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100mm linear expansion as required, and as indicated on the Drawings.

.2 Watertight expansion fittings with internal bonding jumper suitable for linear expansion and 19mm deflection in all directions.

.3 Provide expansion fittings at the exit point at each end (above grade) of all underground services and conduits and where indicated on the drawings.

2.5 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Surface mount conduits except PVC.

.3 Use rigid aluminum steel threaded conduit for all surface mount conduit unless otherwise indicated.

.4 Use liquid tight flexible metal conduit for final connection to instrumentation, motors or vibrating equipment; located in non-hazardous area. Maximum of 900 mm before converting to rigid conduit.

3.1 INSTALLATION (Cont'd)

.5 Minimum conduit size: 21 mm unless indicated otherwise.

.6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.7 Mechanically bend steel conduit over 19 mm dia.

.8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.9 Install fish cord in empty conduits.

.10 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.11 Dry conduits out before installing wire.

.12 Install conduit sealing fittings in hazardous areas in accordance with the Canadian Electrical Codes. Fill with compound. All conduits leaving a hazardous area must be sealed using a conduit sealing fitting.

.13 Rigid PVC conduit shall be FT4 rated.

.14 Seal conduit sleeves penetrating into the wet-well using dux seal.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to structure lines.

.2 Group conduits wherever possible on surface channels.

.3 Do not pass conduits through structural members except as indicated.

.4 Provide offsets for conduits entering surface mounted enclosures and device boxes and fittings.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to structure lines.

.2 Slope conduits to provide drainage.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Excavating, Trenching and Backfilling: Section 31 23 10.

.2 Direct Buried Underground Cable Ducts: Section 33 65 76.

PART 2 - PRODUCTS

2.1 CABLE PROTECTION

.1 Protection materials and methods as indicated on drawings.

2.2 MARKERS

.1 Plastic warning tape, 50mm wide, clearly marked as follows:
.1 "CAUTION - BURIED ELECTRICAL LINE", coloured red.

.2 Pressure treated planks, 50 x 150 mm to LSA 080-15 UC4.1

PART 3 - EXECUTION

3.1 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

3.2 MARKERS

.1 Mark cable continously along runs and changes in direction.

3.2 MARKERS (Cont'd)

.2 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.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 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 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Electrical General Requirements: Section 26 05 00

.2 Moulded Case Circuit Breakers: Section 26 28 21

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 10 10.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 OPERATIONS AND MAINTENANCE DATA

.1 Provide maintenance data for panelboards for incorporation into manual as specified in Section 01 10 10.

PART 2 - PRODUCTS

2.1 PANELBOARDS

.1 Panelboard:

.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 Bus and breakers rated for the interrupting capacity (rms symmetrical) as indicated on the drawings.

.3 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.

.4 Panelboard: mains, number of circuits, and number and size of branch circuit breakers as indicated on the drawings.

2.1 PANELBOARDS (Cont'd)

.5 Provide two (2) keys for each panelboard and key panelboards alike.

.6 Tin-plated, copper busbars with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

.10 Panelboard to be rated NEMA 12.

2.2 BREAKERS

.1 Breakers: as specified in Section 26 28 21.

.2 Bolt-on breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Lock-on devices for 10 % of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.

.4 Provide with connections to suite full size cable connection or suitably sized adapters.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Nameplate for each panelboard size 9 engraved.

.3 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4 ACCEPTABLE MANUFACTURERS

.1 Cutler-Hammer, Square D, Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate panelboard as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on painted (two coats of fire retardant paint, colour to match walls) plywood backboard. Mount panelboard at height indicated. Do not mount panelboards directly to sound suppression walls.

.3 Connect panelboard to source transformer or circuit breaker as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2 No.65-18, Wire Connectors.

1.2 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: 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.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS .1 Submit shop drawings, and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 SWITCHES .1 Heavy duty, specification Grade, 20A, 120V, single pole switches as indicated, with the following features:
.1 Terminal holes approved for #10AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine molding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory nylon, heavy duty toggle.
.6 Integral ground terminal.
.7 Standard of Acceptance: Hubbell #HBL1221I (single pole).

.2 Toggle operated fully rated for lamps, and up to 80% of rated capacity of motor loads.

.3 Switches of one manufacturer throughout project.

.4 Acceptable manufacturers: CWD (Copper Wiring Devices), Leviton, Hubbell, Pass & Seymour.

2.2 RECEPTACLES .1 Design R1:
.1 Heavy duty, specification grade duplex receptacles, CSA type 5-15R, 125V, 15A, U-ground, with following features:
.1 Urea molded housing, ivory colour.
.2 Suitable for #10AWG for back and side wiring.
.3 Break-off links for use as split receptacles as indicated.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.
.6 Nylon face.

2.2 RECEPTACLES (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

.7 Standard of Acceptance: Hubbell #HBL5262I.

.8 Acceptable Manufacturers: Hubbell, Pass & Seymour, CWD (Cooper Wiring Devices), Leviton.

.2 Design R2:

.1 GFI duplex receptacles. Specification grade, CSA type 5-15R, 125V, 15A, U-Ground with the following features:

.2 Ivory urea moulded housing.

.3 Suitable for No. 10 AWG for back and side wiring.

.4 Eight (8) back wired entrances, four (4) side wiring screws.

.5 Triple wipe contacts and riveted grounding contact.

.6 Ivory nylon face.

.7 Trip rating: 4-6 mA.

.8 Tamper resistant.

.9 Visual indication of power 'on' and ground fault condition via LED lights.

.10 Self-testing with test and reset buttons.

.11 Acceptable materials: Hubbell #GFR5262ITRor approved equivalent.

.12 Approved Manufacturers:

.1 Hubbell

.2 Pass & Seymour

.3 Leviton

.4 Eaton Wiring Devices.

.3 Design R3:

.1 GFI duplex receptacles. Specification grade, CSA type 5-20R, 125V, 15/20A, U-Ground with the following features:

.1 Ivory urea moulding housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Eight (8) back wired entrances, four (4) side wiring screws.

.4 Triple wide contacts and riveted grounding contacts.

.5 Ivory nylon face.

.6 Trip rating: 4-6 mA.

.7 Tamper resistant.

.8 Visual indication fo power 'on' and ground fault condition via LED lights.

2.2 RECEPTACLES (Cont'd)

.3 (Cont'd)
.1 (Cont'd)
.9 Self-testing with test and reset buttons.
.10 Acceptable materials: Hubbell #GFR5362ITR or approved equivalent.
.11 Approved Manufacturers:
.1 Hubbell
.2 Pass & Seymour
.3 Leviton
.4 Eaton Wiring Devices.

.4 Other receptacles with ampacity and voltage as indicated.

.5 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Provide cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Self-closing, weatherproof double lift spring-loaded cast aluminum or PVC cover plates, complete with gaskets for duplex or single receptacles as indicated.

PART 3 - EXECUTION

3.1 SWITCH, RECEPTACLE AND COVER PLATE INSTALLATION

.1 Switches:
.1 Install single throw switches with handle in "UP" position when switch closed
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height specified in these Specifications or as indicated on the drawings.
.4 Install size 1 identification lamicoid for control switches for pumps, motors, and existing process equipment.

.2 Receptacles:

3.1 SWITCH, RECEPTACLE AND COVER PLATE INSTALLATION (Cont'd)

.2 (Cont'd)

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in these Specifications or as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CAN/CSA C22.2 No. 248, SET, Low Voltage Fuses Complete Set.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

1.3 MAINTENANCE MATERIALS

.1 Six (6) spare fuses of each type and size.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed.

.3 Store fuses in original containers in moisture free location.

PART 2 - PRODUCTS

2.1 FUSES GENERAL

.1 Fuses: product of one manufacturer.

.2 Low voltage fuses, types as specified, shall be CSA certified in accordance with CSA Standard C22.2 No. 248.

2.2 FUSE TYPES

.1 All fuses shall be high rupturing capacity (HRC) type, minimum 200kA interrupting rating (momentary RMS symmetrical).

2.2 FUSE TYPES (Cont'd)

.2 Class J:
.1 Fuses rated 1 to 600 amperes, 600 Vac, shall be CSA certified Class J in accordance with Standard C22.2 No. 248.8.
.2 Where a time delay characteristic is required, fuses shall carry 500% of their ampere rating for not less than 10 seconds and shall be clearly labeled "time delay".

.3 Class CC:
.1 Fuses rated 1 to 30 amperes, 600 Vac, shall be CSA certified Class CC in accordance with Standard C22.2 No. 248.4.
.2 Where a time delay characteristic is required, fuses shall carry 200% of their ampere rating for not less than 12 seconds.

.4 Standard of acceptance:
.1 Class J: Ferraz Shawmut type A4J (non-time delay) and AJT (time delay) and HSJ (time delay).
.2 Class CC: Ferraz Shawmut type ATMR (non-time delay) and ATDR (time delay) and ATQR (time delay).

.5 Acceptable manufacturers:
.1 Ferraz Shawmut.
.2 Bussmann.
.3 Littlefuse.

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 Ensure fuse size is correctly identified on equipment.

.5 For feeder circuit fuses, use fast acting Class J fuses unless otherwise noted.

3.1 INSTALLATION (Cont'd)

.6 For full voltage non-reversing motor starters, full voltage reversing motor starters, full voltage multi-speed motor starters and transformers, use time delay Class J fuses.

.7 For 600Vac control circuits, use Class CC type fuses. Use time delay Class CC fuses upstream of control transformers and solenoids.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have interrupting rating (momentary RMS symmetrical) as indicated.

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 Provide ground fault interrupter type for circuits so marked.

2.3 MANUFACTURERS

.1 Acceptable manufacturers: Cutler-Hammer, Square D, Siemens or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install circuit breakers as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Electrical General Requirements: Section 26 05 00

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Heavy duty, fusible and non-fusible, horsepower rated, disconnect switch in size and voltage as indicated.

.2 Provision for padlocking in the on and off switch positions by three padlocks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size and type as indicated.

.5 Fuseholders: 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.

.8 Provide equipment identification in accordance with Section 26 05 00.

.9 Switches to be complete with NEMA rated enclosure as noted on the drawings.

.10 Provide switches complete with viewing window to view open/close status of the disconnect switch blades.

.11 Switch to be suitable for service entrance where specified.

2.1 DISCONNECT SWITCHES (Cont'd)

.12 Provide with connections to suit full size cable connection or suitably sized adapters.

PART 3 - EXECUTION

3.1 DISCONNECT SWITCH INSTALLATION

.1 Install disconnect switches complete with fuses as indicated on drawings.

.2 Install new circuit breakers of type and rating/characteristics indicated or as noted on the drawings.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 Furnish and install light fixtures as indicated on the drawings.

1.2 REFERENCES

.1 ANSI/ANSLG C82.11-2011, Specifications for High Frequency Fluorescent Lamp Ballasts.

.2 CAN/CSA C654-2010, Fluorescent Lamp Ballast Efficiency Measurements.

.3 FCC CFR47, USA Federal Communications Commission Frequency Allocations and Radio Treaty Matters; General Rules and Regulations.

.4 IEEE C62.41-02, IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.5 IEEE C62.45-02, IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage (1000V or less) AC Power circuits.

.6 IESNA-RP7-2004, American National Standard - Practice for Industrial Lighting.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Catalogue cuts lacking sufficient detail to indicate compliance with Contract documents will not be acceptable.

.3 Timely submission: shop drawings for all lighting luminaires shall be received no later than thirty (30) days after award of contract.

.4 Review of Shop Drawings or samples does not waive Contract requirements.

.5 Submit complete photometric data prepared by independent testing laboratory for light fixtures for review by Consultant.

PART 2 - PRODUCTS

2.1 LAMPS .1 Incandescent lamps:

Lamp Type	Wattage	Base	Initial Lumens	Rated Life h	Colour Temp	CRI	Additional Info
A21	150W	MED	1700	750	----	---	Frosted
PAR	75W	MED	1500	750	----	---	Flood

2.2 LUMINARIES .1 LED luminaire design L1:
.1 Ceiling mounted, enclosed and gasketed luminaire (factory sealed), suitable for mounting in a moist environment.
.2 Input voltage: 120V.
.3 Lamp: one (1) 15W LED.
.4 Housing, glass reinforced thermoplastic.
.5 Optics: impact resistant dropdown poly carbonate globe.
.6 Options: external hardware to be 316 stainless steel.
.7 Acceptable products: Sceptor LVPE-LED, or approved equivalent.

.2 LED luminaire design L2:
.1 Wall mounted, double lampholder style with double wire guards, suitable for mounting in a moist environment.
.2 Input voltage: 120V.
.3 Lamp: two (2) 12W LED PAR 30 lamps.
.4 Housing: die cast zinc alloy.
.5 Acceptable products: Thomas & Betts S513E with LG-80 guards, or approved equivalent.

.3 LED luminaire design L3:
.1 Wall mounted LED surface mount outdoor alarm light.
.2 Input voltage: 120V, 60Hz, flashing.
.3 Colour: Red
.4 Housing: reinforced thermoplastic
.5 Optics: impact resistant poly carbonate.
.6 Options: Non-metallic dome guard.
.7 Acceptable materials:
.1 Edwards
.2 Federal Signal
.3 Thomas

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Connect fixtures to lighting circuits as indicated.

3.2 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted individually parallel or perpendicular to building grid lines, or as indicated on the drawings.

3.3 LUMINAIRE CLEANING

.1 Contractor to clean all luminaires one week prior to substantial completion.

.2 Replace blemished, damaged, or unsatisfactory luminaries as directed.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 Furnish and install a concrete base and install light fixtures and poles at each location indicted on the drawings, complete with accessories as indicated herein and as indicated on the drawings.

.2 All materials, accessories, and any other equipment necessary for the complete and proper installation of all light poles and fixtures included in this Contract shall be furnished by the Contractor.

PART 2 - PRODUCTS

2.1 STREET LIGHT FIXTURES AND POLES

.1 Electrical contractor to supply the light fixtures and poles. Provide a separate price in tender for the fixtures and poles.

.2 Luminaires:

.1 LED post-top lanterns with curved top, PUR312T series.
.2 55 watt LED lamp module.
.3 Optical tempered clear glass globe.
.4 Asymmetrical Distribution type 2.
.5 347 Volt
.6 Color Temperature: 3000L
.7 Color Rendering Index: 80
.8 Color - Textured Black
.9 Acceptable Manufacturer: LumenPulse

.3 Poles:

.1 27 seamless poles, 100 mm round extruded aluminum shaft welded to cast aluminum muffler base, maintenance opening with copper ground lug and ground bar, complete with anchor bolts, nuts, washers and base cover.
.2 Color - Textured Black
.3 Height - 6.1m (20ft)
.4 Acceptable Manufacturer: LumenPulse

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Connect fixtures to lighting circuits as indicated.

.2 Install each pole and fixture properly and safely.

.3 Install poles true and plumb, in accordance with manufacturer's instructions.

.4 Ground all poles as indicated on drawings.

.5 Install lighting contactor and photo control as indicated on drawings.

3.2 POLE AND FIXTURE CLEANING

.1 Contractor to clean all poles and fixtures one week prior to Substantial Completion.

.2 Replace blemished, damaged, or unsatisfactory poles and fixtures as directed.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.2 RELATED WORK

.1 Electrical General Requirements: Section 26 05 00

.2 Submersible pumping station: Section 33 32 14

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide complete operation and maintenance data in accordance with Section 01 78 00.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Instrumentation and controls equipment to be new and of a proven design for each application and designed, manufactured, inspected, and tested to comply with the applicable regulations, codes, and standards.

.2 Select instrumentation and controls equipment to suit the process and environmental requirements for each application as described or implied in this specification and as indicated on the Drawings.

.3 Construct instrumentation and controls equipment to operate safely and reliably under all operating conditions without undue wear, vibration, heat, noise, or other operating problems. Parts subject to wear, corrosion, or other deterioration, or requiring adjustment, inspection or repair, must be accessible and capable of convenient field maintenance.

2.1 GENERAL (Cont'd)

.4 Proposed instrumentation and controls equipment will be certified by an agency (preferably CSA) recognized by the applicable provincial Electrical Inspection Department. Where there is no alternative to supplying equipment that is not appropriately certified, special approval from the applicable provincial Electrical Inspection Department will be required. Costs associated with obtaining such approval will be the responsibility of the Contractor.

.5 Instrumentation and controls equipment will have a minimum enclosure rating of NEMA 4X (IP66) unless noted otherwise.

.6 Electronic instrumentation and controls equipment installed in hazardous areas must be rated to match its corresponding hazardous area classification (refer to the Electrical hazardous locations on drawings).

.7 Equipment requiring intrinsically safe wiring to meet a hazardous area classification must come complete with all recommended intrinsically safe barriers, etc., as required to meet the applicable hazardous classification.

.8 The minimum instrumentation and controls equipment electrical connection size will be 13 mm NPT.

.9 Instrumentation and controls equipment requiring a power supply will be 120 VAC, 60 Hz.

.10 "Wired" instrumentation and controls equipment must have provision for externally grounding the instrument housing/enclosure.

.11 Instrumentation and controls equipment to be complete with a securely fastened manufacturer's nameplate indicating instrument model, serial number, calibrated range, etc., as required for ordering a replacement item.

.12 All instruments to be EMI and RFI protected.

2.2 PUMP CONTROLLER RTU

.1 Supply completely assembled control panel for the duplex operation of submersible pumps and ventilation fan as follows:
.1 Two (2) pumps at 23HP, three phase, 600V.

.2 Control panel to be CSA certified, NEMA 12 rated panel provided with the following devices or systems: main circuit breaker, PLC controller, radio, ethernet switch, door mounted operator interface, (LED) indicator lights, motor starter resets, fuses, HOA switches, breakers, terminal strips, motor starters, transformers, relays, cabinet heater and thermostat and any other devices indicated or required to safely and efficiently control all aspects of the lift station operations. Panel to have a hinged, gasketed, lockable door. Mount components on mounting rails.

.3 Pumping control panel is to contain full voltage, non-reversing motor starters (NEMA design, minimum size 1, complete with electronic overload relay with ground fault/single phasing protection) for each pump. Each motor starter is to be complete with a separate moulded case circuit breaker, complete with padlocking attachment to lock in the off position. Cutler-Hammer HMCPE breaker design or equivalent.

.4 Programable Logic Controller (PLC), Allen Bradley Micro 850 complete with expansion I/O, related accessories and with spare I/O.
.1 Four (4) Digital inputs.
.2 Two (2) Digital outputs.
.3 Two (2) Analog inputs.
.4 Two (2) Analog outputs.

.5 In addition to the general components, the lift station pump control panel will include the following features:
.1 Provide CTs to monitor pump current on each pump and incoming power phases.
.2 Pump motor overload, over temperature and seal failure protection. Temp/seal relays from pump supplier, complete with door mount installation accessories and reset buttons.

2.2 PUMP CONTROLLER RTU (Cont'd)

.3 Provide phase and ground fault protection.
.4 Provide provision for two (2) float switches for emergency pump control and alarm as indicated complete with intrinsically safe relays.
.5 Provide one intrinsically safe provision for level transmitter for primary pump control.
.6 Provide ground fault type convenience receptacle.
.7 Provide door mounted HOA selector switches, runtime meters, pump LED pilot lights (power on, run indication, alarms) and reset buttons for each pump. 120VAC maximum voltage on door mounted devices.
.8 Provide individually protected 120 V AC circuits for pump control, and 15A panel receptacle circuit and 15A panel heating circuit . Use circuit breakers. Breakers to be the thermal-magnetic type.
.9 Provide 120V and 24V control transformers including primary and secondary fusing for control power. Size for anticipated loads plus 50% additional capacity.
.10 Lightning and surge protection.
.11 Analog inputs are 4 – 20 mAdc. Discrete I/O is 120VAC.
.12 Individual outputs will be protected by fuses in groups of 4.
.13 Provide heater with thermostat on individual breaker.
.14 Common alarm output wired to terminal blocks.
.15 Door mounted operator interface to be suitable for programming all normal operational set-points and displaying operational statuses, flow rate, wet-well level, pump & phase currents, alarms, etc. Allen Bradley 10" Panel View 800 touch screen.
.16 The PLC shall be capable of communications via 900 MHz unlicensed radio to SCADA. Radio complete with directional antenna, mast, lightning protection, stainless steel hardware and cabling. GE Orbit ECR.
Unit must be able to communicate directly to VTScada without additional hardware or programming changes. Panel fabricator to integrate station into Town's SCADA system.
.17 Provide a true on-line UPS in PCL panel to provide at least 15 minutes of back-up power in the event of a loss of power to the

2.2 PUMP CONTROLLER RTU (Cont'd)

control panel. The UPS shall be a Sola SDU series complete with power loss dry contacts or approved equivalent.
.18 Provide logic for duplex pump operation.
.19 Provide pump start staging logic preventing both pumps from starting at the same time.
.20 Install ventilation fan (SF-1) fan controller in control panel.

.6 The operational set points shall be set initially according to the Project Drawings.

.7 Acceptable manufacturer: Belanger Electric.

2.3 FLOW METER

.1 Magnetic flow meter must meet the following design and performance requirements:
.1 Flow meter to be magnetic type suitable for sanitary sewage. The pipe diameter and pipe material is indicated on the drawings. Flow tube assembly to have ANSI Class 150 flanges.
.2 Flow tube liner to be hard rubber and of the "formed" type, complete with SS grid backing.
.3 Flow tube to have minimum 316 SS, self cleaning electrodes.
.4 Flow tube to be suitable for installation with a minimum upstream and downstream pipe lengths and shall be rated for total submergence.
.5 Flow tube to be complete with integral fitted and potted cable. Confirm exact cable length to transmitter to suit field conditions.
.6 Supply grounding hardware for flow meter in accordance with manufacturer's recommendations.
.7 Flow transmitter (converter) to be located remote from the flow tube and be suitable for connection to a 120V, single phase power supply.
Transmitter to have a NEMA 4X enclosure rating.
.8 Flow transmitter to be capable of being programmed locally using keypad via simple menu-driven software. Transmitter to have integral display showing flow rate (engineering units) and totalized flow.
.9 Flow transmitter to have online diagnostics of sensor and transmitter including process checks and linearity and calibration checks.
.10 Flow transmitter to have operator alarm

notification via transmitter display/relay outputs and output signal (4-20mA upscale/downscale manipulation).

2.3 FLOW METER (Cont'd)

.11 Flow transmitter to have HART communication ability.
.12 Flow transmitter to output a 4-20mA analog signal (flow rate) and a pulsed output signal (dry contact) for determining totalized flow.
.13 Flow meter to have a minimum system flow accuracy of ±0.3 %of reading.
.14 Flow meter to have adjustable damping ability.
.15 Flow meter to have an adjustable low-flow cut-off.
.16 Flow meter must be CSA approved.
.17 Flow meter must have a calibrated flow range.
.18 Flow tube to be rated for a Zone 2 installation.

.2 Acceptable manufacturers: Toshiba Mount Anywhere Magmeter, Siemens Mag 5100W with remote mount Mag 6000 Converter, or approved equivalent.

2.4 LEVEL TRANSMITTERS

.1 Submersible level transmitter in a stainless steel housing, suitable for sanitary sewage, complete with 4-20 mA output. Install as per drawings and manufacturer's recommendations.

.2 Sensors: suitable for Zone 1 environment. Provide intrinsically safe barrier and coordinate its installation in the control panel.

.3 Sensor range to be suitable the wet well depth. Shielded cable to be of sufficient length and include vent tube and aneroid bellows. Located bellows in junction box.

.4 Provide sensor complete with surge protection.

.5 Sensor cables to be shielded.

.6 Acceptable manufacturers: KPSI, Ametek or approved equivalent.

2.5 FLOAT SWITCHES

.1 Mechanical float switch c/w SPDT contacts rated at 250 VAC, 10 amps.

2.5 FLOAT SWITCHES (cont'd)

.2 Complete with integral cable, length to suite installation.

.3 Suitable for a Zone 1 hazardous location with intrinsically safe relays.

.4 Acceptable manufacturers: Flygt ENM-10 or approved equal.

2.6 FLOAT HANGER

.1 Galvanized float hanger c/w squeeze connectors and supports to hang excess cable and cable grips.

.2 Acceptable manufacturer: Flygt or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 All work shall be completed in a professional manner and shall present a neat appearance when completed.

.2 All instrumentation and control equipment being supplied by, or issued to, the contractor shall be installed where and as indicated on the drawings, and in accordance with the manufacturer's instructions. Manufacturer's installation instructions shall be strictly adhered to.

.3 The drawings indicate the extent and general arrangement of the instrumentation and controls equipment. Exact installation locations, distances and levels shall be governed by actual field conditions and is subject to approval by the Engineer.

.4 If there are any departures from the original intent of the Drawings and Specifications, details of such departures with the Drawings if necessary, together with the reasons for the departure shall be submitted to the Engineer as soon as practical for approval. No such departure shall be made without prior written consent of the Engineer.

3.1 INSTALLATION (Cont'd)

.5 The contractor shall fabricate and erect all support and mounting brackets required. Contractor supplied instruments shall be purchased with all necessary mounting brackets from the instrument vendor.

.6 Equipment damaged during construction, or otherwise deemed defective or non compliant with the Contract documents shall be repaired/replaced by the Contractor at their expense. These expenses shall include all material, labour and other fees.

3.2 PRIMARY ELEMENTS

.1 Install devices where and as indicated on the drawings and in accordance with manufacturer's instructions.

.2 Panel fabricator and Contractor to coordinate the supply and installation of the flowmeter and level measuring systems.

3.3 TESTING AND CALIBRATION EQUIPMENT

.1 All test and calibration equipment used by the contractor shall be calibrated to an industry recognized standard and have affixed proof of calibration along with date of next calibration.

3.4 TESTING, CALIBRATION AND START-UP

.1 Arrange and pay for services of manufacturer's factory service representative to supervise the installation, start-up, check, adjust, balance and calibrate components and systems to the satisfaction of the Engineer.

.2 Provide services for such period, and for as many visits as necessary to put the installation in working order, and to ensure that the operating personnel are conversant with all aspects of equipment and operation.

.3 Perform a series of start/stops of the pumps under power from the genset to confirm proper operation.

.4 Calibrate program and verify level transmitter. Control elevations to be programmed on-site. Refer to drawings for elevations.

.5 Program, test and calibrate the flow meter.

3.4 TESTING, CALIBRATION AND START-UP (Cont'd)

.6 The results of all tests/calibrations shall be documented by the contractor and made available to the Engineer and shall be included in the project Operations and Maintenance Manual.

.7 The contractor shall be responsible to coordinate with all other division suppliers for their required testing and commissioning procedures.

3.5 COMMISSIONING AND START-UP

.1 Coordinate with the Engineer and the Owner to schedule control supplier, pump supplier and instrumentation supplier for a complete system set-up.

.2 All testing/commissioning shall be coordinated by the Contractor. The Contractor shall arrange and assist the control panel supplier to complete this work. This work will involve a point-by-point check for all control systems monitored field I/O points, logic checks, communication checks, complete pump station controls integration, and equipment start-ups.

.3 Contractor shall provide technical personnel during this phase of the work for instrument recalibration, re-wiring, reprogramming, etc., as required until the pump station control system is deemed ready for operation.

.4 Coordinate with all divisions to perform a complete commissioning.

3.6 ELECTRICAL WIRING

.1 Install only equipment essential for the operation of the pump station inside the wet well.

.2 Locate, where possible, all fans, heaters, switches, and junction boxes, etc, outside the wet well to avoid corrosion or flood damage.

.3 All electrical wiring of the pump station to be designed and supplied by the manufacturer in accordance with the Canadian Electrical Code.

3.6 ELECTRICAL WIRING (Cont'd)

.4 Provide pump power and level regulation cables in sufficient length to run directly to the control panel and/or junction box via an external conduit. Provide conduit fittings and strain relief connectors in sufficient number and size to permit installation of the conduit to the pumping station. All external conduits to enter the control panel enclosure only through the bottom. Seal conduits with an approved gas tight barrier, preventing entry of vapour or gas from the wet well into the control panel. Locate seal to enable motor removal complete with electrical disconnect without disturbing the seal. Where EYS seals are used, a rated junction box is to be employed to allow for pump and instrument removal.

.5 Code all wiring in the pump station either by colour or a numbering system.

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The work to be done under this Section consists of furnishing all materials, labour, tools and equipment and performing all operations necessary to complete all clearing and grubbing as required or directed by the Consultant.

1.2 RELATED WORK

.1 Road Construction: Section 31 24 13

.2 Excavating, Trenching and Backfilling: Section 31 23 10

1.3 PROTECTION

.1 Prevent damage to natural features which are to remain. Make good damage.

.2 Protect root systems of trees to remain.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 CLEARING

.1 Clearing shall include the cutting down and removal of all trees, brush and down timber required for the roadways, drainage ditches, ponds services, lift station, access roads, sports field grading, solar array and as indicated on the drawings.

.2 No trees or brush shall be cut down beyond the limits of construction with the exception of any tree considered unsafe by the Consultant and no such tree shall be cut down unless marked for cutting or as deemed necessary to install the services to the property line.

3.2 GRUBBING

.1 Grub all areas as designated to be cleared in Clause 3.1 of all perishable and organic material, including peat, stumps, roots, down timber, embedded logs and all other objectionable material.

.2 Stumps shall be removed using a stump-pulling machine or other mechanical device approved by the Consultant.

3.3 DISPOSAL

.1 Dispose of materials off-site at no additional cost to the Contract.

.2 Spread grubbing at disposal site in accordance with acceptable environmental practices.

3.4 CLEAN-UP

.1 After clearing, grubbing and disposal, leave area clean.

.2 Obtain Consultant's approval before proceeding with earthwork operations.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for providing erosion and sedimentation control measures.

1.2 RELATED WORK

.1 Excavating, Trenching and Backfilling: Section 31 23 10

.2 Hydraulic Seeding: Section 32 92 19

1.3 REFERENCES

.1 Prince Edward Island Department of Transportation, Infrastructure and Energy General Provisions and Contract Specifications for Highway Construction (Latest Edition)

.2 Prince Edward Island Department of Transportation, Infrastructure and Energy Environmental Protection Plan.

PART 2 - PRODUCTS

2.1 SEDIMENT CONTROL FENCE (SILT FENCE)

.1 Preassembled sediment control fence with industrial woven geotextile fabric, with 20 - 30 micron effective opening size; pre-stapled to pre-weathered oak posts spaced as indicated.
.1 Acceptable product: Envirofence as manufactured by Mirafi Inc., Terrafence as manufactured by Terrafix.

2.2 SEDIMENT CONTROL SOCK

.1 Sock: multi-filament polypropylene tube with 3mm opening, UV stabilized to resist degradation.
.1 Acceptable products: Terrafix Silt Sock Ultra or approved equivalent.

.2 Fiber Fill: 60 to 50mm virgin wood fiber, free of weeds, seed & foreign material

2.3 EROSION CONTROL MAT

.1 Mat: agricultural straw blanket covered in biodegradable jute netting, UV stabilized to resist degradation.

.1 Acceptable products: Terrafix S100B or approved equivalent.

.2 Anchoring: 150mm to 300mm long U-shaped anchors minimum No.11 gauge wire or approved biodegradable anchors.

2.4 MATERIALS

.1 Fill for sediment containment area embankments: approved material from site excavation or borrow pits. Such material shall be free from stumps, trees, roots, sod, or other deleterious material, and shall not contain rock, boulders or masonry larger than 200 mm in diameter. The material shall be free from frost, and shall not be placed on frozen ground or in water. It must have:
.1 A hydraulic conductivity of at least $1x10^{-6}$ cm/sec.

.2 Mulch: hay mulch reasonably free of noxious weeds as per the Weed Control Act and other undesirable materials. Mulch to be reasonably dry and in a condition that allows for uniform spreading.

PART 3 - EXECUTION

3.1 GENERAL

.1 Adhere to all Federal and Provincial legislation.

.2 Provide erosion and sedimentation control features where required or as directed, prior to construction. Co-ordinate locations with Consultant.

.3 Provide and maintain temporary sediment control features installed under this Contract. Do not remove control features until authorized by the Consultant.

.4 Fires and burning of rubbish on site is not permitted.

3.2 SEDIMENT CONTROL FENCE (SILT FENCE)

.1 Install sediment control fence in the locations directed.

.2 Install extra 50 x 75 x 1200 mm long posts midpoint between supplied posts. Attach fence with roofing nails and roofing tins. Provide wood strapping along top of fence as shown.

.3 Excavate 150 x 150 mm trench along length of fence as indicated. Lay fabric bottom in trench and backfill with selected backfill material.

3.3 SEDIMENT CONTROL SOCK

.1 Install sediment control sock in the locations directed and stake per the manufacturers recommendations.

2. Level any existing vegetation, remove sticks & roots that may cause underflow. In excavated areas, excavate 50mm trench, lay sock in trench and backfill with selected backfill material.

3.4 EROSION CONTROL MAT

.1 Install erosion control mat in the locations directed by the Consultant and as per the manufacturers recommendations.

3.4 SEDIMENT CONTAINMENT AREAS

.1 Do not place material which is frozen or place material on frozen surfaces.

.2 Place and compact selected excavated material to full width in uniform layers not exceeding 200 mm loose thickness. Engineer may authorize thicker lifts if specified compaction can be achieved.

.3 The footprint below any embankment must first be cleared of vegetation (grubbed) and any loose, soft, or otherwise unsuitable foundation soil removed, exposing the surface of the in-situ material.

.4 The interior slopes of sediment containment areas are to be 4H:1V and the exterior slopes are to be 3H:1V.
Sediment containment areas are to be constructed with material containing a hydraulic conductivity of at least $1x10^{-6}$ cm/sec.

.5 Fill material to be compacted to 98% of the Modified Proctor dry density as determined by ASTM Test Method D1557. The minimum density, the moisture content of the fill must be controlled within ±1% of the optimum moisture content that corresponds to the maximum dry
density.

.6 The Contractor's Geotechnical Engineer is to confirm that the in-situ and fill materials for the sediment containment areas meet specifications and is properly compacted. All geotechnical testing will be incidental to the work.

3.5 TEMPORARY SOIL COVERS

.1 Hay mulch is to be installed using mechanical means if areas is too large for hand application.

.2 Hay mulch shall be spread evenly and uniformly over the designated areas with a minimum coverage rate of 95% as deemed acceptable by the Consultant.

.3 Where blown hay mulch is used to protect new seeding, control the thickness of the application to avoid smothering of the seed. If used in lieu of environmental blanket, uniformly apply straw and hay blown onto the seeded areas. Thickness depends on site conditions, seed mix, slope, and soil type.

3.4 MAINTENANCE

.1 Maintain sedimentation control features throughout the construction period. Repair damage to original condition.

.2 Remove accumulated sediment from behind sediment control fence, berms, and and silt sock and remove sediment in sediment containment areas as required and as directed by the Consultant.

.3 Maintain vertical alignment of sediment control fence such that it is always plumb and straight.

.4 Remove sedimentation control features when directed by the Consultant. Take care to avoid causing turbidity, and excessive re-suspension of particles when removing sediment control features.

.5 Remove accumulated sediment from sediment containment areas at the end of construction before site de-mobilization.

3.5 DISPOSAL OF WASTES

.1 Dispose of rubbish and waste materials at authorized off-site locations.

.2 Do not dispose of waste, volatile or deleterious materials into waterways, storm or sanitary sewers.

3.6 DEWATERING

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 Control disposal or runoff of water containing suspended materials or other harmful substances with use of sediment control fences, berms and the like, all in accordance with required environmental regulations, permits and approval.

.4 Have in place, all necessary permits and approvals related to the discharge of excavation water prior to starting excavation.

.5 Maintain all siltation prevention and control measures until discharge of excavation waters is completed and sufficient settling of suspended solids has occurred.

3.7 TREE AND PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties outside designated limits, using method approved by the Consultant.

.2 Protect roots of trees outside designated limits during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.3 Restrict tree removal to areas indicated or designated by Consultant.

3.8 POLLUTION CONTROL

.1 Maintain temporary erosion and pollution control devices installed under this Contract.

.2 Control emissions from equipment to requirement of authority having jurisdiction.

.3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.5 Keep paved surfaces clean. Control dust by application of water, or calcium chloride after obtaining permission from the Consultant.

3.9 FUEL SPILL CONTAINMENT

.1 Take precautions to avoid contamination of the site from fuel. Keep and maintain hydrocarbon containment and clean up materials on site for the duration of construction activities. Train all personnel in the proper use of such materials.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for performing all operations necessary to complete ditch and swale construction beyond the limits of the R.O.W., general site grading and providing borrow materials required to bring the site to finished elevations shown on Drawings.

1.2 RELATED WORK

.1 Section 31 23 33 - Excavating, Trenching and Backfilling.

.2 Section 32 92 19 - Hydraulic Seeding.

1.3 PROTECTION

.1 Prevent damage to existing fencing, trees, natural features, bench marks, existing pavement, and surface or underground utility lines which are to remain. Repair damage caused during construction, at no extra cost to the Contract.

1.4 SITE CONDITIONS

.1 A soils investigation has been carried out at the site. The findings of the investigation are included in this document and can be found in appendix A. The soils investigation was carried out to determine the characteristics of the sub-soil for design purposes and is provided in this document for information only.

.2 Known underground and surface utility lines and buried objects are indicated on the plans. Locations are to be considered as approximate. Verify in field prior to commencing excavation.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Commom borrow is as per Section 31 23 10 Excavating, Trenching and Backfilling.

.2 Common borrow for wet pond embankments: material from site excavation or borrow pits. Such

material shall be free from stumps, trees, roots, sod, or other deleterious material, and shall not contain rock, boulders or masonry larger than 200 mm in diameter. The material shall be free from frost, and shall not be placed on frozen ground or in water. It must have:

.1 A moisture content ±1% of optimum that will allow compaction to the specified densities.

.2 A hydraulic conductivity of at least $1x10^{-6}$ cm/sec and an average plasticity index of 7 or more prior to construction.

.3 Selected borrow as per section 31 23 10 Excavating, Trenching and Backfilling.

.4 Hydroseeding: as per Section 32 92 19 - Hydraulic Seeding.

PART 3 - EXECUTION

3.1 EXCAVATING

.1 The contractor will be responsible to excavate to the elevations shown on the drawings. All slopes are to match construction drawings and are to be confirmed by the contractor's surveyor.

.2 Advise Engineer sufficiently in advance of excavation operations for initial cross-sections to be taken.

.3 Maintain crowns and cross slopes to provide good surface drainage.

.4 Notify Engineer whenever unsuitable materials are encountered and remove unsuitable materials to depth and extent directed.

.5 Excavate in all kinds of material encountered on the site and make own computations of amount and nature of excavation required.

.6 Perform all excavation within +/- 25 mm of the lines, grades and dimensions shown on the Drawings or as established by the Engineer. During the progress of the Work, the Engineer may vary the lines, grades and dimensions of the

3.1 EXCAVATING (Cont'd)

excavations from those specified in this Section.

.7 Take necessary precautions to preserve the material below and beyond the lines of all excavation in the soundest possible condition.

.8 Do not obstruct existing drainage ditches and natural watercourses unless indicated on the Drawings.

.9 During construction direct surface runoff to sediment control facilities installed and maintained to the requirements of Section 01 35 43 - Environmental Protection.

3.2 EMBANKMENTS

.1 Do not place material which is frozen or place material on frozen surfaces.

.2 Maintain a crowned surface during construction to ensure ready run-off of surface water.

.3 Place and compact selected excavated material to full width in uniform layers not exceeding 200 mm loose thickness. Engineer may authorize thicker lifts if specified compaction can be achieved.

.4 The footprint below the embankment must first be cleared of vegetation (grubbed) and any loose, soft, or otherwise unsuitable foundation soil removed, exposing the surface of the in-situ material.

.5 The downstream slopes of the new embankment are to be at 3H: 1V and the upstream slopes are 4H: 1V.

.6 Embankment fill to be compacted to 98% of the Modified Proctor dry density as determined by ASTM Test Method D1557. The minimum density, the moisture content of the fill must be controlled within ±1% of the optimum moisture content that corresponds to the maximum dry density.

3.3 FINISHING

.1 Remove soft or other unstable material that will not compact properly and fill resulting depressions with approved material.

3.3 FINISHING (Cont'd)

.2 Shape and compact entire subgrade to within 25 mm of design elevations but not uniformly high or low.

.3 Do scarifying, blading, compacting or other methods of work as necessary to provide a thoroughly compacted site shaped to grades indicated or directed.

.4 Finish side slopes to a neat condition, true to lines and grades indicated.
.1 Remove boulders encountered and fill resulting cavities.
.2 Hand finish slopes that cannot be finished satisfactorily by use of machine.

.5 Dispose of surplus approved embankment material not required for placement in fills and material unsuitable for grading or landscaping off-site.

3.4 COMPACTION TESTING

.1 Contractor to arrange for and pay for independent compaction testing of all materials used in site grading and finishing.

.2 Compaction testing to be performed by an accredited soils testing company to the approval of the Engineer.

3.5 HYDRAULIC SEEDING

.1 Conduct hydraulic seeding in accordance with Section 32 92 19 - Hydraulic Seeding.

3.6 MAINTENANCE

.1 Maintain finished surfaces in a condition conforming to this section until final acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 This Section specifies requirements for furnishing all materials, labour, tools and equipment and performing all operations necessary to strip topsoil from areas designated, complete excavation of all types of material encountered, placing of excavated material as backfill in trenches and embankments, disposal of unsuitable material, spreading of suitable surplus material, and furnishing backfill material as specified below, all as shown on the Drawings and as specified.

.2 The work generally includes, but is not necessarily limited to, the following items:

.1 Trench excavation and backfilling for structures, pipelines, conduit and appurtenances.

.2 Structure excavation and backfilling for manholes, catch basins and lift station.

.3 Control of water by dewatering.

.4 Providing borrow material when required.

.5 Removal and disposal of unsuitable material.

.6 Spreading suitable surplus material as shown on the Drawings.

.7 Sheeting, shoring, trench box and bracing to support trench walls, sides of excavations, existing structures or utilities.

.8 Stripping, stockpiling and replacing topsoil.

1.2 RELATED SECTIONS

.1 Watermains: Section 33 11 00

.2 Sanitary Sewer: Section 33 31 00

.3 Storm Sewer: Section 33 42 13

.4 Roadway Construction: Section 31 24 13

.5 Site Grading and Finishing: Section 31 22 13

.6 Submersible Pumping Station: Section 33 32 14

.7 Forcemains: Section 33 34 00

1.2 RELATED SECTIONS (Cont'd)

.8 Direct Buried Underground Cable Duct Section 33 65 76

1.3 REFERENCES

.1 ASTM C117-90. Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-84a. Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698-91. Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.4 Current PEI DTI General Provisions and Contract Specifications for Highway and Bridge Construction.

1.4 DEFINITIONS

.1 Excavation: excavation of materials of whatever nature including dense tills, hardpan, frozen materials, boulders, bedrock, debris and all other materials encountered on the site.

.2 Selected Backfill: excavated on-site material suitable for grading work.

1.5 PROTECTION OF EXISTING FEATURES

.1 Existing buried utilities and structures:
.1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed. Carry out test digs as required to locate services, etc.

1.6 SHORING AND BRACING

.1 Comply with Section 01 35 28 Health and Safety Requirements and applicable local regulations.

.2 Provide shoring and bracing as required to prevent movement, failure or settlement, to safeguard and maintain integrity of structures, utilities, earth, benchmarks, services and adjacent grades.

.3 Engage services of qualified Professional Engineer registered in the Province of Prince

Edward Island to inspect and approve shoring equipment required for work.

1.7 SAMPLES

.1 When requested submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 At least 2 weeks prior to commencing work, inform Consultant of proposed source of bedding, backfill or cover materials and provide access for sampling.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Common Borrow: where material additional to that obtained from excavation on site is required to complete trench backfilling the Contractor will provide this material from his own sources as an extra to the Contract. Material shall be as per DTI requirements Division 206.

.2 Select Backfill Material: approved material from site excavation or borrow pits. Such material shall be free from stumps, trees, roots, sod, muck or other deleterious material, and shall not contain rock, boulders or masonry larger than 150 mm diameter. The material shall be free from frost, and shall not be placed on frozen ground or in water. It must have a moisture content that will allow compaction to the specified densities.

.3 Gravel Bedding: shall be as per DTI requirements for Class A, Division 401.

2.1 MATERIALS (Cont'd)

.4 Sand bedding material: hard, granular, sharp material, well graded from coarse to fine, free from impurities, chemicals or organic matter, chloride content to be less than 250 ppm and graded as follows:

Sieve Square Opening	% Passing (by weight)
4.75 mm	100
2.00 mm	90-96
0.85 mm	75-94
0.425 mm	45-82
0.250 mm	18-40
0.150 mm	10-17
0.075 mm	0-5

.5 Select Borrow: shall be as per DTI requirements Division 206.

.6 Geotextile fabric: non woven geotextile terrafix 270R or equivalent.

.7 Rip-Rap: Per PEI DTI Specification 213 for random Rip-Rap size and class as indicated on drawings.

.8 Clear stone: Hard durable clear stone 6 mm to 19 mm, crushed and screened, free from clay and organic matter.

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 in accordance with PEI DTI and Department of Environment.

.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 SITE PREPARATION

.1 Remove obstructions 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.

3.3 STOCKPILING

.1 Stockpile fill materials in areas designated by Owner's Representative. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.4 STRIPPING OF TOPSOIL

.1 Strip all surficial vegetation, rootmat and topsoil. Do not mix topsoil.

3.5 PREPARATION/ PROTECTION

.1 Keep excavations clean, free of standing water and loose soil.

.2 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.

.3 Protect buried services that are required to remain undisturbed.

3.6 SHORING AND BRACING

.1 Construct temporary works to depths, heights and locations as indicated or directed by the Professional Engineer responsible for the design of the shoring or bracing.

.2 During backfill operation:

.1 Unless otherwise indicated or as directed by Owner's Representative, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached that specified by the Professional Engineer responsible for the design of the shoring or bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an

3.6 SHORING AND BRACING (Cont'd)

elevation at least 500 mm above toe of sheeting.

.3 When sheeting is required to remain in place, cut off tops at elevations as directed by Consultant.

.4 Upon completion of substructure construction:
.1 Remove shoring and bracing.
.2 Remove excess materials from site and restore conditions indicated or as directed by Consultant.

3.7 DEWATERING

.1 Conduct dewatering operations in accordance with Section 01 35 44 - Environmental Protection.

.2 Keep all excavations and trenches free of water at all times. Control excavations to prevent surface water running into excavated areas.

.3 Do all work in connection with dewatering and supply and maintain on the work site, pumps, in number and capacity sufficient to keep bottom of all excavations dry and free from water at all times so placing of pipe and concrete will be done in the dry. Operate all equipment for as long as necessary.

.4 Dispose of water removed from excavations in a manner that will prevent injuries to public health or private property or to any operation of the work completed or under construction. Pumping of water containing silt or other material in suspension into streams or drainage courses is prohibited.

.5 Ensure that all sub-drains, sump holes, wells or the like required for dewatering shall not endanger the stability of the Works. On completion of the work completely backfill and consolidate excavations.

.6 Excavate, remove, or thaw out frozen ground as necessary.

3.8 EXCAVATION

.1 Carry out excavations and removals. Excavate to lines, grades, elevations and dimensions as indicated.

.2 Remove rubble and other obstructions encountered during excavation.

.3 For trench excavation, unless otherwise authorized by Consultant in writing, do not excavate more than 30 m of trench in advance of installation operations.

.4 Dispose of surplus and unsuitable excavated material in approved location off site in accordance with PEI Department of Environment regulations.

.5 Do not obstruct flow of surface drainage.

.6 Earth bottoms of excavations to be solid undisturbed soil, level, free from loose, soft or organic matter.

.7 Notify Consultant when soil at bottom of excavation appears unsuitable and proceed as directed by Owner's Representative.

.8 Obtain Consultant's approval of completed excavation.

.9 Remove unsuitable material from trench bottom to extent and depth as directed by Consultant.

.10 Where required due to unauthorized over excavation, correct as follows:
.1 Fill under bearing surfaces and footings with approved structure fill compacted to 100% Standard Proctor Dry Density.
.2 Fill under other areas compacted to a minimum of 95% Maximum Dry Density.

.11 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.12 Obtain excavation permit prior to starting any on-site excavations.

3.9 FILL TYPES AND COMPACTION

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.

.2 Within trenches:
.1 For pipes, cables, ducts, fittings and appurtenances, install bedding as follows: Provide min. 150 mm bedding layer of bedding sand under pipes, cables, ducts, fittings and appurtenances. Compact to 95% of Maximum Dry Density. Side fill to top of utility or service manually with beddings and in uniform lifts not exceeding 150 mm. Hand tamp only.

.3 Backfill: provide min. 300 mm protective backfill cover over bedding cover, hand-place. Compact to 95% of Maximum Dry Density. For remainder of trench backfill to underside of sub-base course or of surface restoration in lifts not to exceed 200 mm. Compact to 95% of Maximum Dry Density.

.4 Notify Consultant four hours prior to backfilling of trenches.

3.10 BACKFILLING

1 Do not proceed with backfilling operations until Owner's Representative has inspected and approved installation.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 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.

.5 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 225 mm.

3.10 BACKFILLING (Cont'd)

.6 Where earth pressures are liable to develop permit concrete to cure for minimum 28 days to withstand earth and compaction pressures. Do not install earth or backfill until concrete has cured completely.

.7 Place protective material layer under, around and over minor installations until 600 mm of cover is provided. Dumping material directly on installations will not be permitted.

.8 Place backfill materials of earth fill around structure in uniform layers not exceeding 200 mm compacted thickness up to finish grade. Compact each layer replacing succeeded layer.

.9 Where new services cross under existing services, compact bedding for existing service pipe to 150 mm below bottom of pipe and provide a cast-in-place cradle for length of unsupported pipe.

3.11 INSPECTION AND TESTING

.1 The Contractor shall submit gradation curves for proposed materials to demonstrate compliance with specifications. Pay all costs for gradation curves.

.2 Have an independent testing laboratory carry out testing of materials and compaction. Frequency of tests will be determined by Consultant.

.3 Where tests or inspections by designated testing laboratory reveal work not in accordance with contract requirements, Contractor shall pay costs for additional tests or inspections as Consultant may require to verify acceptability of corrected work.

3.12 RESTORATION

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Consultant.

.2 Clean and reinstate areas affected by work as directed by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for performing all operations necessary to complete all stripping, cold planning (milling) stockpiling and placement of topsoil, road excavation, road embankment, grading, fine grading, and supply and placement of granular materials, required to bring the roadway and trail to the elevations shown on Drawings.

1.2 RELATED WORK

.1 Excavating, Trenching and Backfilling: Section 31 23 10

.2 Asphalt Tack Coat: Section 32 12 15

.3 Asphalt Paving: Section 32 12 16

.4 Roadway Dust Control: Section 32 15 60

.5 Storm Sewer: Section 33 42 13

.6 Site Grading and Finishing: Section 31 22 13

.7 Erosion and Sediment Control: Section 31 15 53

1.3 DEFINITIONS

.1 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Waste material: material unsuitable for use in embankment or surplus to requirements.

.3 Borrow material: material obtained from areas off site required for construction of embankments or for other portions of work.

.4 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to subgrade elevation.

.5 Pavement structure: combination of layers of unbound or stabilized sub-base, base, and asphalt or concrete surfacing.

.6 Subgrade elevation: elevation immediately below pavement structure.

.7 Geogrid: Soil stabilization sheeting required for construction of road embankments over soft sub-grades such as peat.

1.4 TRAFFIC PROVISIONS

.1 Provide and maintain roadways, walkways and detours, for vehicular and pedestrian traffic, and access to fire hydrants, alarms and emergency telephones.

1.5 PROTECTION

.1 Prevent damage to fencing, trees, natural features, bench marks, existing pavement, or surface or underground utility lines which are to remain. Make good any damage.

.2 The native till is susceptible to softening and loss of strength if exposed to excess precipitation. Make good any corrections at no additional cost to the contract.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Materials to approval of Consultant.

.2 Material used for embankment not to contain organic matter, frozen lumps, weeds, sod, roots, logs, stumps, boulders larger than 150 mm or any other unsuitable material.

.3 Subbase shall be select borrow as per DTI requirements Division 206.

.4 Granular base shall be Class A gravel as per DTI requirements Division 401.

.5 Structural fill shall be select borrow as per DTI requirements Division 206.

.6 Topsoil shall be as per DTI requirements Division 212.

.7 Obtain approval of excavated or graded material used as fill for grading work. Protect approved material from contamination. Cut material can be used as fill in the roadway construction subgrade provided specified compaction can be achieved.

PART 3 - EXECUTION

3.1 COMPACTION EQUIPMENT

.1 Compaction equipment must be capable of obtaining required densities in materials on project.

3.2 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution.

3.3 GENERAL

.1 Carry out grading operations involving the till subgrade during dry periods only.

.2 Place the select borrow subbase over the subgrade immediately.

.3 Direct surface water away from exposed areas.

.4 Roll and grade the surface of graded areas at the end of each day's activities to prevent infiltration of water.

.5 Have a geotechnical engineer carry out the Department of Transportation and Infrastructure construction control testing requirements and ensure compliance with the general provisions and contract specifications for highway construction. Costs for geotechnical engineer shall be paid by the contractor and all test reports including witnessing of proof rolling shall be submitted to the Engineer.

.6 The frequency of sampling and grain size analysis for select borrow shall be one test every 560 m3 of material placed instead of DTI sampling frequency.

3.4 VEGETATIVE MATTER/TOPSOIL

.1 Strip and stockpile vegetative matter/topsoil suitable for placement in the works, dispose of unsuitable materials, such as trees, brush, stumps and fill or muck. Use stripped/stockpiled material for reinstatement of all disturbed areas and remove surplus material from the site. Supply shortfall from own sources.

3.5 COLD PLANING (MILLING)

.1 Mill existing asphalt that is to be removed and dispose off site.

3.6 EXCAVATIONS

.1 Remove topsoil and rootmat.

.2 Excavate in all kinds of materials encountered and make own computations of amounts and nature of excavation required.

.3 Maintain crowns and cross slopes to provide good surface drainage.

.4 Construct ditches to profiles indicated.

3.7 SUBGRADE, SUB-BASE AND EMBANKMENTS

.1 Do not place material which is frozen or place material on frozen surfaces.

.2 Maintain a crowned surface during construction to ensure ready run-off of surface water. Bring up low areas to the required sub grade level cut material or with structural fill compacted to at least 98% of Standard Proctor density.

.3 Prior to placement of the subbase, proof roll the sub-grade surface with a loaded tandem. Remove and replace materials exceeding the maximum allowable deformation of 13 mm with cut material or structural fill. Have a geotechnical engineer present during proof rolling to confirm conditions.

.4 Compact roadway sub-base and base materials to a density of not less than 100% Standard Proctor density.

.5 Shape and compact entire roadbed to within 25 mm of design elevations but not uniformly high

3.7 SUBGRADE, SUB-BASE AND EMBANKMENTS (Cont'd)

or low. Before and after placing subbase, provide a table of cross section elevations at 20 M intervals and at beginning of vertical curves, end of vertical curves and at low/high point stations, showing the design and as constructed elevations, demonstrating that the specified tolerance has been achieved and that the road is not uniformly high or low.

.6 Bring moisture content of soil to level required to achieve specified compaction. Add water or aerate as required.

.7 Place granular material to compact thickness as indicated.

.8 Place and compact in two even layers to compacted thickness indicated. Compact to a density of 100% Standard Proctor Density.

.9 Fine grade granular material to be within 12 mm of specified grade, but not uniformly high or low. Before paving, provide a table of cross section elevations at 20 M intervals and at beginning of vertical curves, end of vertical curves and at low/high point stations showing the design and as constructed elevations, demonstrating that the specified tolerance has been achieved and that the road is not uniformly high or low.

3.8 FINISHING AND TOLERANCES

.1 Notwithstanding the acceptable tolerance, work specified elsewhere may require more precise grading to ensure successful achievement of the work (i.e., pavements).

.2 Do scarifying, grading, compacting or other methods of work as necessary to provide thoroughly compacted roadbed shaped to grades and cross sections as indicated or as directed.

.3 Finish edges and slopes of common material to neat condition, true to line and grade.
.1 Remove isolated boulders exposed in cut slopes and fill resulting cavities.
.2 Hand finish slopes that cannot be finished satisfactorily by machine.

3.9 MAINTENANCE .1 Maintain finished surfaces in condition conforming to this section until acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This Section specifies requirements for performing all operations necessary to complete all stripping, stockpiling and placement of topsoil, stockpiling of suitable surplus excavated material from trenching, roadway and trail construction, and grading required to bring sports field area to the elevations shown on Drawings.

1.2 RELATED WORK

.1 Environmental Protection Procedures: Section 01 35 44

.2 Topsoil Placement and Grading: Section 32 91 21

.3 Hydraulic Seeding: Section 32 92 22

.4 Excavation, Trenching and Backfilling: Section 31 23 10

.5 Erosion and Sediment Control: Section 31 15 53

1.3 PROTECTION

.1 Prevent damage to fencing, trees, natural features, bench marks, existing pavement, or surface or underground utility lines which are to remain. Make good any damage.

.2 The native till is susceptible to softening and loss of strength if exposed to excess precipitation. Make good any corrections at no additional cost to the contract.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Materials to approval of Consultant.

2.1 MATERIALS (Cont'd)

.2 Material used for embankment shall be suitable surplus excavated material from onsite construction of the municipal and electrical infrastructure, roads and trails and shall not to contain organic matter, frozen lumps, weeds, sod, roots, logs, stumps, boulders larger than 150 mm or any other unsuitable material.

.3 Topsoil shall be as per Section 32 91 21.

.4 Obtain approval of excavated or graded material used as fill for grading work. Protect approved material from contamination. Cut material can be used as fill in the sports field area subgrade provided specified compaction can be achieved.

PART 3 - EXECUTION

3.1 COMPACTION EQUIPMENT

.1 Compaction of fill material shall be achieved during the rough grading process using an excavator of dozer.

3.2 GENERAL

.1 Place and level suitable surplus excavated material from onsite excavations in 900mm lifts. Carry out grading operations involving the till subgrade during dry periods only.

.2 Direct surface water away from exposed areas.

.3 Level and shape the surface of graded areas at the end of each day's activities to prevent infiltration of water.

.4 Avoid over compaction of the sub-base.

3.3 VEGETATIVE MATTER/TOPSOIL

.1 Strip and stockpile vegetative matter/topsoil suitable for placement in the works, dispose of unsuitable materials, such as trees, brush, stumps and fill or muck. Use stripped/stockpiled material for reinstatement of all disturbed areas and remove surplus material from the site. Supply shortfall from own sources.

3.4 EXCAVATIONS

.1 Remove topsoil and rootmat.

.2 Excavate in all kinds of materials encountered and make own computations of amounts and nature of excavation required.

.3 Maintain crowns and cross slopes to provide good surface drainage.

.4 Construct ditches to profiles indicated.

3.5 SUBGRADE, SUB-BASE AND EMBANKMENTS

.1 Do not place material which is frozen or place material on frozen surfaces.

.2 Maintain a crowned surface during construction to ensure ready run-off of surface water. Bring up low areas to the required sub grade level with cut material or with surplus excavated material in lifts not exceeding 900mm.

.3 Shape and compact entire subgrade to within 25 mm of design elevations but not uniformly high or low. Before and after placing topsoil, provide a table of cross section elevations at 10m grid, showing the design and as constructed elevations, demonstrating that the specified tolerance has been achieved and that the is site not uniformly high or low.

3.6 MAINTENANCE .1 Maintain finished surfaces in condition conforming to this section until acceptance.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

.1 This section covers asphalt tack coat between layers/lifts of asphalt.

1.2 REFERENCES

.1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

.2 ASTM D140-88, Practice for Sampling Bituminous Materials.

1.3 SAMPLES

.1 Upon request, submit samples in accordance with Section 01 33 00 - Submissions/Shop Drawings, Product Data, Samples and Mock-ups.

.2 Submit, in plastic containers to Consultant, two - 4 L samples of asphalt tack coat material proposed for use at least 2 weeks prior to commencing work

1.4 ASPHALT MATERIAL CERTIFICATION

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 EQUIPMENT

.1 Pressure distributor to be:
.1 Designed, equipped, maintained and operated so that asphalt material:
.2 Is maintained at even temperature. May be

3.1 EQUIPMENT (Cont'd)

applied uniformly on variable widths of surface up to 5 m.
.3 May be applied at readily determined and controlled rate of 0.14 L/m² with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.04 L/m²

.2 Capable of distributing asphalt material in uniform spray without atomization at temperature required.

.3 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.

.4 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.

.5 Equipped with an easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.6 Equipped with accurate volume measuring device or calibrated tank.

.7 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

3.2 APPLICATION

.1 Apply tack coat only on clean and dry surface. Obtain Consultant's approval of surface before applying asphalt tack coat.

.2 Dilute asphalt emulsion with water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Consultant.

.3 Apply tack coat evenly to pavement surface at rate as directed by Consultant but do not exceed 0.7 L/m^2.

.4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.

.5 Do not apply asphalt tack coat when air temperature is less than 5°C or when rain is forecast within 2 hours of application.

.6 Apply tack coat only to base coarse surfaces that are expected to be overlaid on same day.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Consultant.

.8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.

.9 Keep traffic off tacked areas until tack coat has set as directed by Consultant.

.10 Re-tack contaminated or disturbed areas as directed by Consultant.

.11 Permit tack coat to set before placing asphalt paving.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Current PEI DTI Standard Specification, Division 600.

1.2 SAMPLES

.1 Submit to Consultant, samples of material for sieve analysis at least 2 weeks before beginning Work.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Prime coat, tack coat and asphalt cement shall be as per DTI Specifications, Division 500. Grade of asphalt cement shall be as recommended by an approved materials testing authority and accepted by DTI.

.2 Asphaltic material: hot-mixed, hot-laid combination of mineral aggregates, uniformly coated and mixed with an asphaltic binder in a suitable mixing plant. Asphaltic materials and aggregates shall meet the requirements of Section 603 of the Prince Edward Island Department of Transportation and Infrastructure Specification.

.3 Composition of mixture: to grading and asphalt content requirements in Table 4, Section 603 of the Prince Edward Island Department of Transportation and Infrastructure Specification. Base course asphalt shall be Mix Type A, thickness shown on the Drawings. Seal course asphalt shall be Mix Type B, thickness shown on Drawings.

PART 3 - EXECUTION

3.1 FOUNDATIONS

.1 Compaction: compact each lift of granular material to 100% maximum density to ASTM D 698. Maximum lift thickness: 150 mm.

3.2 GENERAL

.1 Coordinate, pay costs for and have Department of Transportation and Infrastructure construction control testing requirements performed and ensure compliance with the General Provisions and Contract Specifications for Highway Construction.

3.3 EQUIPMENT

.1 Pressure distributor:
.1 Distributor to be designed, maintained, equipped and operated that asphalt material at even temperature may be applied in a uniform manner on width up to 4.5 metres at readily determined and controlled rates.
.2 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.2 Cold Planer: Self propelled with automatic longitudinal and transverse grade and slope controls. Equipped with a loading conveyor to facilitate removal of milled asphalt by truck.

3.4 ASPHALT PAVING

.1 Prior to laying mix, clean surface of loose and foreign material.

.2 Place asphalt concrete to thicknesses, grades and lines indicated unless otherwise directed by Consultant. Carryout interface with existing asphalt as per DTI Specification 705.

.3 Placing conditions:
.1 Place asphalt only when air temperature is above 5°C for base course, and 10°C for surface course.
.2 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.
.3 Do not place asphalt concrete when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Place, roll, and compact asphalt concrete to Section 603, Province of Prince Edward Island, Department of Transportation and Infrastructure, Standard Specification.

3.4 ASPHALT PAVING (Cont'd)	.5	Asphalt seal to be placed in the spring following placement of asphalt base.
3.5 THICKNESS AND FINISH TOLERANCES	.1	Thickness and finish tolerances shall be as per DTI specifications 603.11.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Excavating, Trenching and Backfilling: Section 31 23 10

1.2 MEASUREMENT FOR PAYMENT

.1 Supply and application of water for dust control is incidental to the work, to be included in overall tendered price.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Supply water in quantities and at times as directed by Owner's Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Water: potable to Owner's Representative's approval.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Apply water with equipment approved by Owner's Representative at rate of 0.5 to 5.0 l/m^2 as appropriate when directed by Owner's Representative.

.2 Apply water with distributors equipped with spray system to ensure uniform application and with means of shut-off.

3.2 CLEANING

.1 Progress Cleaning: leave work area clean at the end of each day.

.2 Final Cleaning: upon completion, remove surplus materials and debris.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Asphalt Paving: Section 32 12 16.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB 1.74-01, Alkyd Traffic Paint.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.3 CGSB 1-GP-12c-68, Standard Paint Colours.

.4 CGSB 1-GP-74M-79, Paint, Traffic, Alkyd.

.5 TAC Manual of Uniform Traffic Control Devices for Canada.

1.3 ACTION AND INFORMATIONAL 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 copies of WHMIS MSDS in accordance with Section 01 35 28 - Health and Safety Requirements 01 35 44 - Environmental Procedures.

.3 Samples:
.1 Submit to Consultant following material sample quantities at least two (2) weeks prior to commencing work.
.1 Two (2) 1 L samples of each type of paint.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:
.1 Store materials 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 CGSB 1-GP-74M, alkyd traffic paint.
.2 Colour: to TAC Manual of Uniform Traffic Control Devices for Canada, Part C.

.2 Thinner: to CAN/CGSB-1.5.

.3 Cold plastic: two component, solvent-free, field-reacting, road marking material.
.1 Approved product: Permamark Hand Grade as manufactured by Road Services International or approved equal.

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 Consultant.

.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 mobile 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 Lay out pavement markings as approved by the Consultant. Employ GPS survey equipment.

.2 Unless otherwise approved by the Consultant, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.

.3 Apply traffic paint evenly at rate of 3 m^2 /L.

.4 Do not thin paint unless approved by Consultant.

.5 Symbols and letters to dimensions of the TAC Manual of Uniform Traffic Control Devices of Canada, Part C.

.6 Paint lines: of uniform colour and density with sharp edges.

.7 Thoroughly clean distributor tank before refilling with paint of different colour.

.8 Install cold plastic pavement markings in conformance with manufacturer's recommendations.

3.4 TOLERANCE

.1 Paint markings: within plus or minus 12 mm of dimensions indicated.

.2 Remove incorrect markings by method approved by the Consultant.

3.5 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 SCOPE OF WORK

.1 This section specifies topsoil, topsoil amendments, the stripping of topsoil, the preparation of existing grades, the placement of topsoil, and finish grading.

1.2 RELATED SECTIONS

.1 Environmental Protection Procedures: Section 01 35 44

.2 Site Grading and Finishing: Section 31 22 13

.3 Hydraulic Seeding: Section 32 92 22

.4 Reinstatement: Section 32 98 00

1.3 TESTING

.1 All soil and sand used in this project shall be tested for compliance with texture specification by a laboratory designated by the owner. Soil sampling, testing and analysis to be in accordance with Provincial regulations and standards. Contractor will arrange and pay for cost of tests.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Divert unused soil amendments from landfill to a Provincially approved hazardous material collections site.

.3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 – PRODUCTS

2.1 TOPSOIL

.1 Topsoil for this project to consist of topsoil stripped from site and imported topsoil to be supplied by the Contractor.

.2 Topsoil: mixture of mineral particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth, free of debris, weeds, foreign objects, toxic materials and stones and roots greater than 20 mm length.

.3 Soil texture: sandy loam, based on The Canadian System of Soil Classification, to the following particle distribution and gradation:

Particle Type	Distribution by volume	Acceptable Range
very coarse sand	10%	10% or less
coarse & medium sand	45%	42-47%
fine sand	15%	13-17%
very fine sand	10%	8-12%
clay	20%	18-23%

Particle Type	Gradation
very coarse sand	2.0-1.0 mm
coarse sand	1.0-0.5 mm
medium sand	0.5-0.25 mm
fine sand	0.25-0.15 mm
very fine sand	0.15-0.106 mm
clay	less than 0.06 mm

.4 Organic matter: 4-20% by dry weight volume, well decomposed and stable. Organic material measuring 20 mm will not exceed 2% by volume.

.5 pH range: 6.0-7.0

.6 Consistency: friable when moist.

.7 Fertility: major soil nutrients present in following ratios:
.1 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil
.2 Phosphorus (P): 10 to 20 micrograms of phosphate per gram of topsoil.
.3 Potassium (K): 80 to 120 micrograms of potash per gram of topsoil.
.4 Calcium, magnesium, Sulphur and/or establishment of intended vegetation.

2.2 SOURCE QUALITY CONTROL

.1 Advise Engineer of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Contractor is responsible for amendments to supply topsoil as specified.

PART 3 - EXECUTION

3.1 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of areas after all wood, brush and grasses have been removed from site.

.2 Strip and pulverize topsoil to depths as indicated. Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.3 Stockpile in locations as directed by Owner's Representative. Stockpile height not to exceed 6 m.

.4 Unused topsoil is to be removed from site.

.5 Protect stockpiles from contamination and compaction.

3.2 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct. If discrepancies occur, notify Engineer and do not commence work until instructed by Department Representative.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 25 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Place topsoil after Engineer has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150 mm.

.3 Spread topsoil/planting soil to following minimum depths after settlement.
.1 100 mm for seeded areas.
.2 500 mm for shrub beds.

.4 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.4 SOIL AMENDMENTS

.1 For planting beds and turf areas: apply and thoroughly mix soil amendments into full specified depth of topsoil at following rates recommended by soil analyses.

3.5 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Engineer. Leave surfaces smooth, uniform and firm against deep foot printing.

3.6 ACCEPTANCE

.1 Engineer 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 surplus materials off site.

3.8 CLEANING

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

PART 1 - GENERAL

1.1 SCOPE OF WORK

.1 This Section specifies seed, mulch, slurry preparation and application, and maintenance for hydraulic seeding.

1.2 RELATED SECTIONS

.1 Environmental Protection Procedures: Section 01 35 44

.2 Topsoil Placement and Grading: Section 32 91 21

.3 Reinstatement: Section 32 98 00

1.3 SUBMITTALS

.1 Upon request, provide product data for:
- .1 Seed.
- .2 Mulch.
- .3 Tackifier.
- .4 Fertilizer.

1.4 SCHEDULING

.1 Schedule hydraulic seeding to coincide with preparation of soil surface.

.2 Schedule hydraulic seeding to be completed not later than September 30 without written approved from Consultant.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Divert unused fertilizer from landfill to Provincially approved hazardous material 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 SEED

.1 "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.

.2 Mixture composition:
.1 60% Creeping Red Fescue
.2 20% Hard Fescue
.3 10% Perennial Rye
.4 10% White Clover

2.2 MULCH

.1 Specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
.1 Made from wood cellulose fibre.
.2 Organic matter content: 95% plus or minus 0.5%.
.3 Value of pH: 6.0.
.4 Potential water absorption: 900%.

2.3 TACKIFIER

.1 Water soluble vegetable carbohydrate powder.

2.4 WATER

.1 Free of impurities that would inhibit germination and growth.

2.5 FERTILIZER

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations". Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

2.6 INOCULANTS

.1 Inoculant containers to be tagged with expiry date.

PART 3 - EXECUTION

3.1 WORKMANSHIP

.1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.

.2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Consultant.

.3 Do not perform work under adverse field

conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

.4 Protect seeded areas from trespass until plants are established.

3.2 PREPARATION OF SURFACES

.1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.

.2 Ensure areas to be seeded are moist to depth of 150 mm before seeding.

.3 Obtain Consultant's approval of grade and topsoil depth before starting to seed.

3.3 FERTILIZING PROGRAM

.1 Fertilize prior to fine grading incorporating fertilizer equally distributed in accordance with the following program.

.2 Following germination, all seeded areas to receive an application of fertilizer at rate specified by fertilizer manufacturer after one cut.

.3 Apply additional soil supplements as determined necessary by soils analysis conducted during establishment period.

3.4 PREPARATION OF SLURRY

.1 Measure quantities of materials by weight or weight-calibrated volume measurement.

.2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.

.3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry

3.5 SLURRY APPLICATION

.1 Hydraulic seeding equipment:
.1 Slurry tank.
.2 Agitation system for slurry to be capable of operating during charging of tank and during

seeding, consisting of recirculation of slurry and/or mechanical agitation method.
.3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
.4 Slurry mixture applied per 100 square metres.
.1 Seed: Grass mixture 2.0 kg.
.2 Mulch: 10 kg.
.3 Tackifier: as recommended by manufacturer.
.4 Water: Minimum 100 litres.
.5 Fertilizer: 0.5kg, Type 1 5-20-20

.2 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.

.3 Using correct nozzle for application.

.4 Using hoses for surfaces difficult to reach and to control application.

.5 Blend application 300 mm into adjacent grass areas or sodded areas to form uniform surfaces.

.6 Re-apply where application is not uniform.

.7 Remove slurry from items and areas not designated to be sprayed.

.8 Protect seeded areas from trespass.

.9 Remove protection devices as directed by Consultant.

3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operation from time to seed application until acceptance by Consultant.

.2 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.

3 Mow grass once whenever it reaches height of 90 mm. Remove clippings which will smother grass.

.4 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles; water in well.

.5 Control weeds by mechanical or chemical means utilizing integrated pest management practices approved by the Owner.

.6 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.7 ACCEPTANCE

.1 Seeded areas will be accepted by Consultant provided that:

.1 Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.

.2 Areas have been mown at least twice.

.3 Areas have been fertilized.

.2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.8 MAINTENANCE DURING WARRANTY PERIOD

.1 Perform following operations from time of acceptance until end of warranty period.

.2 Repair and reseed dead or bare spots to satisfaction of Consultant.

.3 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

3.9 CLEANING

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

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The work to be done under this Section consists of furnishing all materials, labour, tools and equipment and performing all operations necessary for the complete reinstatement of surfaces and structures disturbed by work of this Contract.

.2 Repair damage or disturbance to surfaces, properties and structures, within limits of the Site or elsewhere on other properties occupied, traversed or otherwise used by the Contractor during the Contract period to a condition equal to or better than that before work began, at no additional cost to the Contract.

1.2 RELATED WORK

.1 Excavating, Trenching and Backfilling: Section 31 23 10

.2 Asphalt Paving: Section 32 12 16

.3 Topsoil Placing and Grading: Section 32 12 21

.4 Hydraulic Seeding: Section 32 92 22

1.3 REFERENCES

.1 PEI DTI General Provisions and Contract Specific for Highway and Bridge Construction latest edition.

1.4 MAINTENANCE

.1 Contractor shall take care and maintain all reinstated areas until final acceptance of the work.

.2 Repair damaged areas to the approval of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Granular material: in accordance with the requirements of Section 31 23 10.

.2 Concrete material: as specified in Section 03 30 00.

.3 Asphalt material: as specified in Section 32 12 16.

.4 Grass surface materials: as specified in Sections 32 92 22.

PART 3 - EXECUTION

3.1 GENERAL

.1 Maintain surfaces to be reinstated level with adjoining existing surfaces gravel until final reinstatement.

3.2 CONCRETE SURFACES

.1 Carry out final reinstatement of concrete surfaces as follows:

.1 Cut back broken edges of original concrete to full depth, in straight lines.

.2 Before placing final surface material, remove existing gravel to a depth indicated over disturbed area, grade and recompact. Add gravel to compacted depths indicated. Compact to not less than 100% Maximum Corrected Dry density.

.3 Place and finish concrete in accordance with Section 03 30 00.

.4 Ensure finished surface is even, dense and matches grade of existing road or surface, as approved by the Engineer.

3.3 ASPHALT SURFACES

.1 Keep surface of asphalt paved roads and surfaces in good condition by repairing settlement of trench backfilling as described in Section 31 23 10.

.2 Carry out final reinstatement of asphalt surfaces as follows:

.1 Cut back broken edges of original pavement to full depth, in straight lines. Cut back 300 mm minimum from edge of excavation to eliminate tension cracks. Clean contact surfaces and apply tack coat before placing asphalt concrete.

.2 Before placing final surface material, remove existing gravel to a depth indicated over disturbed area, grade and recompact. Add gravel to compacted depths indicated. Compact to not less than 100% Maximum Corrected Dry density.

.3 Supply, place, roll and compact asphalt mixture in accordance with Section 32 12 16.

.4 Compact asphalt concrete in lifts not exceeding 50 mm in thickness.

.5 Ensure finished surface is even, dense and matches grade of existing road or surface, as approved by the Engineer.

3.4 GRAVEL SURFACES

.1 Reinstate gravel surfaces by placing 200 mm compacted thickness of gravel at an elevation such that gravel surface is smooth and even with adjacent surfaces.

.2 Place and compact gravel for surfaces in accordance with the requirements of PEI DTI Renewal Standard Specifications.

3.5 GRASS SURFACES

.1 Seeding: to Section 32 92 22. Fine grade areas to be reinstated to smooth surface. Grade to allow for topsoil and seed to be placed so finish grade is smooth and even with existing surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies the requirements for constructing water mains and service connections. Work includes supply, installation and testing of pipe, fittings, and related appurtenances.

1.2 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA B300-[18], Standard for Hypochlorites.

.2 ANSI/AWWA B301-[18], Standard for Liquid Chlorine.

.3 ANSI/AWWA C104/A21.4-[16], Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

.4 ANSI/AWWA C111/A21.11-[17], American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.

.5 ANSI/AWWA C110/A21.10-[12], American National Standard for Ductile-Iron and Gray Iron Fittings for Water.

.6 ANSI/AWWA C153/A21.53-[19], Standard for Ductile-Iron Compact Fittings.

.7 ANSI/AWWA C500-[19], Standard for Metal-Seated Gate Valves for Water Supply Service.

.8 ANSI/AWWA C600-[17], Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.

.9 ANSI/AWWA C651-[14], Standard for Disinfecting Water Mains.

.10 ANSI/AWWA C800-[14], Standard for Underground Service Line Valves and Fittings.

.11 ANSI/AWWA C900-[16], Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300mm),for Water Transmission and Distribution.

.2 ASTM International

.1 ASTM A 307-[10], Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.2 ASTM B 88M-[09], Standard Specification for Seamless Copper Water Tube [Metric].

.3 Stratford Utility Corporation Municipal Servicing Standard

1.3 RELATED SECTIONS

.1 Excavation, Trenching and Backfilling: Section 31 23 10

.2 Cast in Place Concrete: Section 03 30 00

.3 Reinstatement: Section 32 98 00

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 for all pipe, fittings, valves and all other items necessary for a complete water main installation.

1.5 CERTIFICATES

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 33 00.

1.6 HANDLING AND STORAGE

.1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables passing through pipe bore. Do not damage coatings or linings.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

.3 Store hydrants and valves to prevent retention of water and damage by freezing.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

.1 Polyvinyl chloride pressure pipe: to AWWA C900, Class 235 and CSA B137.3. Push on joint with continuous rubber-moulded lining gasket to AWWA C111.

2.2 FITTINGS

.1 Fittings 200 mm dia. and smaller shall be PVC. Fittings 250 mm dia. and larger can be PVC or DI.

.2 AWWA C153, cement mortar lined to AWWA C104 and coated outside with standard coatings. Lead tipped gasket not permitted.

.3 PVC conforming to AWWA C907 certified to CSA Standard B137.3.

2.3 HYDRANTS

.1 Dry barrel type: to AWWA C502 and as follows:
.1 Depth of bury: as per drawings.

.2 Barrel: two-piece with safety break-away flange stem.

.3 Main valve: compression type, 134 mm minimum diameter.

.4 Inlet connection: mechanical joint, 150 mm diameter.

.5 Nozzles: two hoses and one pumper to Town of Stratford Standard.

.6 Direction of opening: counterclockwise.

.7 Operating nut: 19 mm pentagon.

.8 Acceptable products:
.1 McAvity Brigadier 'M67'

.9 Hydrant marker: fabricate from 40 mm O.D. polyethylene pipe, with ductile iron base plate. Pipe shall be fluorescent orange in colour and have an overall height of 1.8 M. Standard of acceptance: as manufactured by CKT Investmetns, Winnipeg, Manitoba.

2.4 GATE VALVES

.1 Standard buried type: to AWWA C509 up to and including 300 mm, minimum working pressure rating 1380 kPa and as follows:
.1 Body: cast-iron with mechanical joint ends.
.2 Mechanism: solid resilient wedge, epoxy coated, bonnet, S.S., packing gland nuts and

bolts, non-rising spindle, and O-ring seals.
.3 Direction to close: clockwise.
.4 Operating nut: 50 mm square.
.5 Acceptable products:
.1 Clow McAvity F-6100 Resilient Seat Valve
.2 Mueller A2360-23 Resilient Wedge Valve
.3 AVK Series 25/00 Resilient Seat

.2 Epoxy coat all gate valves with minimum 150 microns coating.

2.5 VALVE BOXES

.1 To AWWA C500 and as follows:
.1 Two piece sliding type with cover and centering disc, adjustable for depth of pipe below finished grade.
.2 Covers marked "Water".
.3 Lugged to prevent turning and rolling of cover, and cover notched to suit.
.4 Have clear opening of 135 mm.
.5 Bonnet on the bottom section which is capable of enclosing the packing gland section of the gate valve.
.6 Acceptable products:
.1 Mueller MVB composite valve box.

2.6 ANODES

.1 #12 Zinc Anodes to ASTM B-418, Type 2 Zinc.

2.7 BOLTS FOR BURIED SERVICE

.1 T-head bolts and nuts:
.1 Low alloy Corten steel

2.8 SERVICE PIPE AND FITTINGS

.1 Service connections 100 mm and larger refer to pipe specifications subsection 2.1.

.2 Domestic services 50 mm and smaller:
.1 Copper tubing: to ASTM B88, type K annealed, minimum pressure rating 1035 kPa.
.2 Joints: compression type, minimum pressure rating 1035 kPa.
.3 Corporation stop: brass to ASTM B62, compression type, inlet threads to AWWA C800, minimum pressure rating of 1035 kPa.
.1 Acceptable products:

.1 19-50mm Mueller H15008

.4 Curb stop and drain: brass to ASTM B62, compression type joints. Minimum pressure rating of 1035 kPa.

.1 Acceptable products:

.1 19-50mm Mueller H15219 (Oriseal)

.5 Tapped coupling: PVC conforming to AWWA C907 and certified to CSA Standard B137.3.

.6 Service Box: adjustable type, cast iron bottom section, stainless steel operating rod and cotter pin, cast iron lid with recessed pentagon nut and internal stem to suit depth of bury. Service boxes are to be magnetized to facilitate future locates. Service box to have appropriate foot piece. 38 mm and 50 mm curb stops to be fitted with full size valve boxes.

.1 Acceptable products:

.1 Mueller 726 (19 and 25 mm dia.)

.2 Mueller 728 (38 and 50 mm dia.)

2.9 COUPLINGS

.1 Mechanical joint sleeve type: to AWWA C110; use on new ductile iron pipe. Provide spacer ring between pipe ends. Where gap between pipe ends is less than 10 mm, spacer not required.

2.10 THRUST RESTRAINT

.1 Thrust blocks and anchors: Minimum 25 mpa compressive strength.

.2 Joint restraint device: 100 mm to 600 mm joint restraint device to AWWA C111 and C153 for mechanical or push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 2410 KPa and minimum safety factor of 2:1. No special tools shall be required for installation.

.1 Acceptable products:

.1 Ebaa Iron Megalug

.2 Clow

.3 Sigma

.4 Uni-Flange

2.11 DISINFECTANT

.1 Sodium hypochlorite or calcium hypochlorite: to AWWA B300.

.2 Liquid chlorine: to AWWA B301.

2.12 REDUCING AGENT

.1 Hydrogen peroxide, 35% by mass commercial grade.

2.13 INSULATION

.1 Rigid polystyrene insulation to CGSB-51.20, type 4, minimum compressive strength 41.5 KPG (60 psi). Standard of Acceptance: HI60 by Dow Chemical Canada.

2.14 MARKER STAKE

.1 Timber marker stake - 40 mm x 90 mm painted blue. Must be installed as location marker for end of service at property line.

2.15 GEOSYNTHETIC

.1 Synthetic fibre, rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents. Non-woven construction, with minimum thickness of 2 mm and minimum density of 200 g/m2.

2.16 MARKER TAPE AND TRACING WIRE

.1 Underground warning tape: minimum 75 mm wide, metal detector tape, clearly marked "Caution - Buried Waterline", Colour Blue.

2.17 PIPE BEDDING

.1 Sand Bedding: as per Section 31 23 10.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Carefully inspect products for defects and remove defective products from site.

.2 Ensure that pipe, fittings, valves and hydrants are clean before installation.

3.2 TRENCHING, BEDDING AND BACKFILLING

.1 Provide trenching, bedding and backfilling to Section 31 23 10.

.2 Use sand bedding for pipe bedding and protection unless otherwise specified.

.3 Clear stone may be used in wet or freezing conditions only where specified or with the prior approval of the engineer.

3.3 BURIED PIPE INSTALLATION

.1 Lay and join pipe, fittings, and valves, as specified herein and according to manufacturer's published instructions.

.2 Do not lay pipe and fittings when trench bottom is frozen, under water or when trench conditions or weather are unsuitable.

.3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within the following tolerances:
.1 Horizontal Alignment: 150 mm
.2 Vertical Alignment: 75 mm

.4 Face bell ends in direction of laying. On grades of 5% or greater, lay pipe up grade. For grades exceeding 16%, install appropriately designed gradient thrust restraint.

.5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.

.6 Do not use excessive force to join pipe sections.

.7 Install gaskets in accordance with manufacturer's published instructions. Use only lubricant approved for potable water. During cold weather, store gaskets in heated area to assure that gaskets remain flexible.

.8 Align pipes carefully before joining.

.9 Support pipes as required to assure concentricity until joint is properly completed.

.10 Keep pipe joints free from mud, silt, gravel or other foreign materials.

.11 Avoid displacing gasket or contaminating with dirt, or other foreign material. Remove, clean, re-install and lubricate gaskets so disturbed. Do not reuse a gasket that has been contaminated with petroleum products.

.12 Complete each joint before laying next length of pipe.

.13 Where deflection at joints is permitted by the Engineer, deflect only after spigot is fully inserted in bell. Do not exceed 50% of joint deflection recommended by manufacturer.

.14 At structures, provide flexible joint not more than 300 mm from outside face of structure. Support pipe between structure wall and first joint with 20 MPa concrete

.15 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating. Leave smooth beveled edge.

3.4 HYDRANT INSTALLATION

.1 Install hydrants at locations indicated or where directed.

.2 Install 150 mm gate valve and valve box on hydrant anchor tee, as indicated.

.3 Set hydrant plumb, with hose outlets parallel to roadway, pumper connection facing roadway and breakaway flange.

.4 Provide mechanical joint restraint on all joints from the hydrant tee to the hydrant. In addition to joint restraint, provide concrete thrust blocks on all hydrants. Do not obstruct drain holes.

.5 Provide drainage not less than 0.5 m^3 in volume and backfill with clear stone to a level 150 mm above top of hydrant lead from hydrant to main.

.6 Place geosynthetic over clear stone from hydrant to main.

.7 Install Anode on Hydrant and valve as recommended by manufacturer.

.8 Where water table is above drain holes, notify Consultant. Where hydrant cannot be appropriately relocated, plug drain holes and advise Consultant.

3.5 VALVES AND VALVE BOXES

.1 Install valves at locations indicated. Joints and bedding as specified for pipe and fittings.

.2 On direct buried valves, install valve boxes plumb and centered over operating nut, and true to line and grade.

.3 Install Anode on valves to manufacturers recommendation.

.4 Place select backfill material, maximum size 50 mm around valve box to subgrade.

.5 When valves are installed with cover in excess of 2.0 m, provide a valve stem extension.

3.6 THRUST RESTRAINT

.1 Provide formed thrust blocks to undisturbed ground on all tees, bends, reducers, plugs and caps. Keep joints and couplings free of concrete and construct, so as to avoid conflict with manholes in dual pipe trenches.

.2 Backfill over thrust blocks when concrete has sufficient strength and can withstand earth pressure.

.3 Provide mechanical joint restraint devices where specified.

.4 Place double polyethylene on bend before pouring concrete thrust block.

3.7 SERVICE LATERAL CONNECTIONS

.1 General:
.1 Services shall not be installed in driveways or parking areas.

.2 Water services to maintain 1.5 m horizontal separation from electrical conduit, communications, transformer pads, utility poles, gas lines, or other utilities.

.3 Maintain minimum of 1.8 metre ground cover on service connections. Maximum depth of bury shall not exceed 2m.

.4 Lay service pipe in a smooth trench bottom with sand bedding 150 mm below the pipe and a minimum 300 mm over the pipe.

.5 Backfill with well graded Selected Backfill.

.6 Install anode on service piping with appropriate sized clamp.

.7 Install service box over curb stop, set plumb with the top of service box flush with finished grade. Where grade has not been finalized or established, leave the top of service box 150 mm above top of curb or edge of asphalt. Place select backfill material, maximum size 50 mm, around the service box to subgrade.

.8 Leave corporation stop fully open. Operate curb stop to ensure flow, then close curb stop and leave closed.

.9 Place temporary marked stake at end of each service lateral, extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake blue.

.10 Tapped couplings are to be used for service connections to the new watermain.

.1 Follow manufacturer's instructions including installing to recommended torque. Check torque for each installation.

.2 Maintain minimum 1000 mm between adjacent service coupling, fitting, or pipe joint. Roll coupling so that corporation stop is orientated at the 2:00 o'clock or 10:00 o'clock position.

.3 Leave corporation stop fully open.

3.8 COMMISSIONING PLAN .1 The Contractor shall provide a Water System Commissioning Plan outlining the measures that will be taken for the hydrostatic testing, chlorination and disinfection of the water system. This plan is to indicate the areas to be tested, the sequence of testing and the sample locations for bacteriological tests. This plan

shall follow all requirements set forth in this specification and be provided to and approved by the Engineer prior to any testing taking place. Unless otherwise approved, the maximum length of water main that can be tested shall be limited to 450m.

3.9 LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic test.

.2 The operation of any existing valve not part of the new construction, shall be by Utility staff. 24 hours notice is required by the Utility for all filling, flushing or chlorination operations for new construction.

.3 All services, hydrants, mains and other appurtenances shall be included in the system test.

.4 Perform tests in presence of the Engineer or his representative.

.5 All valves must be pressure tested, including hydrant valves.

.6 Where hydrant extensions are required, install extensions prior to testing.

.7 Open all valves in test section.

.8 Expel air from main by slowly filling with potable water. Install corporation stops at high points where no air-vacuum release valves are installed.

3.10 PIPEWORK

.1 Test pipework after backfilling.

.2 Ensure all air release valves on section being tested are installed and operational before testing. Fill watermain, for testing. Pipeline to remain filled for not less than 24 hours prior to pressure test. Ensure all air is purged before starting pressure and leakage tests.

.3 Gradually increase water pressure inside pipe until it reaches 1035 kPa at the lowest location

under test. Maintain pressure test for two hours.

.4 Measured leakage of water as measured by a water meter approved by the Consultant.

$$Qm = (LDP^{1/2})/795,000$$

Where: Qm = allowable leakage, in litres/hr.
L = length of pipeline in metres
D = diameter of pipe in millimetres
P = average test pressure in kilopascals

.5 The allowable leakage shall not be exceeded between adjacent valves.

.6 Replace, at no cost to Contract, all pipes, valves, fittings, and couplings which are defective. Perform test at no cost to Contract until pipeline is approved by Consultant.

3.11 TESTS TO BE REPEATED

.1 Should tests disclose leakage, locate and repair defective pipes, or joints, to approval of Consultant.

.2 Tests to be carried out, at Contractor's expense to determine success or otherwise of remedial measures applied to pipework. These tests to be repeated at Contractor's expense until results show that remedial measures have been successful.

.3 Following acceptance of field tests, should the Consultant suspect the watermain, for any reason, no longer complies with requirement of the test, he may order a second test and should the length of pipeline prove defective, Contractor shall repair or make good defect at his own expense.

.4 Cost of this second test to be borne by Contractor if test proves a defect. However, if this second test shows pipe to be satisfactory, cost of second test will be borne by Authority.

3.12 FLUSHING AND DISINFECTION

.1 Chlorination of any water system can proceed only after system has been successfully pressure

tested. The chlorination test is to be witnessed by the Engineer.

.2 Flush and disinfect water mains to AWWA C651 and as herein specified. Notify the Engineer 24 hours in advance of flushing and disinfection.

.3 Flush water mains with potable water through available outlets until foreign materials have been removed and water is clear. The size and number of taps should conform to Table 3 of AWWA C651.

Pipe Diameter	Flow required to produce 0.91m/s (approx) velocity in main	Size of Tap (mm)			Number of 64mm hydrant outlets
		25	38	51	
(mm)	(L/s)	Number of taps on pipe			
100	7.4	1	-	-	1
150	16.7	-	1	-	1
200	29.7	-	2		1
250	46.3	-	3	2	1
300	66.7	-	-	3	2
400	118.6	-	-	5	2

Per AWWA C651-14 Table 3

.4 Slowly open and close valves and hydrants to ensure thorough flushing.

.5 If satisfactory results cannot be achieved by flushing, swab pipe by approved methods and re-flush.

.6 Disinfect water main upon completion of flushing using chlorine solution distributed throughout entire system.

.7 Inject 1% chlorine solution through a corporation stop in the top of newly laid pipe, at point close to where main is being filled and at rate proportioned to filling rate. Prepare stock chlorine with concentration of 1% free chlorine by volume as follows:

Product	Amount Of Compound	Quantity of Water (litre)
high test calcium hypochlorite (67-70%C1)	1.0 kg	60 litres
liquid laundry bleach (5.25% CI)	1.0 litre	3.5 litres
3.5 litres (10.5% C1)	1.0 litre	7.0 litres

.8 Calcium hypochlorite is not to be used when water temperature is less than 5 C.

.9 The following table indicates the quantity of 1% chlorine stock solution required per 100 metre length of pipe.

Pipe Diameter (mm)	1% Chlorine Solution (litres)
100	4.9
150	10.9
200	19.4
250	30.4
300	42.9
350	58.4
400	76.3

.10 Operate valves, hydrants, and appurtenances while main contains chlorine solution.

.11 Take water samples at all hydrants and termination points, in suitable sequence, to test chlorine residual. When tests indicate minimum chlorine residual of 50 mg/L, leave system charged with disinfectant solution for 24 hours. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 25 mg/L. If the residual has fallen below 25 mg/L the system shall be rechlorinated.

.12 Flush disinfectant solution from line after 24 hours. Under no circumstances shall disinfectant solution remain in the line longer than 48 hours. Add 1.0% hydrogen peroxide reducing agent to the

disinfectant solution at point of discharge or within a retention facility such that the solution is disposed to the environment with a total chlorine residual no greater than 0.0 mg/L in accordance with the requirements of the Department of Environment. Check chlorine residuals before disposal and at regular intervals during disposal to ensure compliance. This de-chlorination requirement can only be excluded with the written consent of the Department of Environment, Labour and Justice.

.13 Dispose of de-chlorinated disinfectant solution. Where disposing to the environment, disposal of the de-chlorinated solution must be at least 100 meters from the nearest watercourse.

.14 Where disinfectant solution is de-chlorinated at point of discharge, inject stock reducing agent at a rate proportioned to discharge rate. Injection and discharge rates must be monitored continuously to ensure proper proportioning.

.15 Prepare stock reducing agent with concentration of 1% Hydrogen Peroxide (H^2O^2) by volume, as follows:

Liquid Reducing Agent	Amount of Agent (litres)	Quantity of Water (litres)
Hydrogen Peroxide (35% H2O2 by mass) 34.0	1.0	34.0

.16 The following table indicates quantity of 1% Hydrogen Peroxide required to reduce total chlorine residual of disinfectant solution contained per 100 metre length of pipe, from 50 mg/L to 0.0 mg/L.

Pipe Diameter (mm)	1% Hydrogen Peroxide Stock Solution (litres)
100	4.5
150	10.2
200	18.1
250	28.2
300	40.6
350	55.3
400	72.3

.17 Where total chlorine residual of disinfectant solution exceeds 50 mg/L, quantity of stock reducing agent for de- chlorination can be increased in direct proportion to the quantity indicated in the above table.

.18 After disinfectant solution is flushed from water main, assist Engineer's representative in obtaining two water samples on each of two consecutive days (at least 24 hours apart) for bacteriological tests. Hydrants shall not be used as sampling points. Repeat disinfection procedure if bacteriological tests fail.

.19 Bacteriological samples are to be obtained from a test sampling tap or a copper service lateral if available. Sampling shall take place from every 366m (1200 ft) of new water main, plus one set from the end of the line and from every branch (See AWWA C651-14, Section 5.1). Coliform tests must indicate 0 on two consecutive days combined with background count of less than 150.

.20 Should any of the test results be positive, repeat disinfection, flushing, sampling and analysis.

.21 After testing and submission of the written results for the passing of the bacteriological tests, remove corporation stops and install plugs. Check visually for leakage after plugs are installed with water main under normal operating pressure.

3.13 CONNECTIONS TO EXISTING MAIN

.1 Connect new mains to existing mains as indicated.

.2 Do not make a connection to an existing main within 1.0 m of a fitting, pipe joint or another service.

.3 The Utility does not guarantee leak tight operation of existing valves.

.4 No work will be performed on existing main until all items required to complete the connection are on site and the outside diameter and type of pipe have been confirmed.

.5 The Utility will operate valves in the exiting system.

.6 When a connection is made to an existing main (ie. inserting a new tee) an inspection of the joints for leakage must be made by the Utility, while the main is under operating pressure, prior to backfilling.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Excavating, Trenching and Backfilling: Section 31 23 10

.2 Precast Structures: Section 33 39 00

.3 Submersible Pumping Station: Section 33 32 14

1.2 REFERENCES

.1 CAN/CSA-B1800-06,Thermoplastic Nonpressure Piping Compendium.

.2 Stratford Utility Corporation Municipal Servicing Standards.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Submit shop drawings for all pipe, fittings, valves, and all other items necessary for a complete installation. Include details showing dimensions and tolerance of pipe and joint proposed.

1.4 MATERIAL CERTIFICATIONS

.1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section.

.2 Ensure certification is marked on pipe.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Handle and store pipe, valves, fittings, in such a manner as to avoid shock and damage and as per manufacturer's recommendations. Do not use chains or cables passed through pipe bore.

.2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

1.6 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services and maintain existing flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Engineer 24 hours minimum in advance of any interruption in service.

PART 2 - PRODUCTS

2.1 SEWER PIPE

.1 PVC pipe and fittings: type PSM polyvinyl chloride, to CAN/CSA-B1800, DR35, complete with bell and spigot joints with locked in rubber gaskets.

.2 Sewer laterals:
.1 Shall be type PSM polyvinyl chloride, to CAN/CSA-B1800, DR28 (white), complete with bell and spigot joints with locked in rubber gaskets.

2.2 PIPE BEDDING MATERIAL

.1 Sand bedding material: as specified in Section 31 23 10.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Clean pipes and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

.2 Obtain Engineer's approval of pipes and fittings prior to installation.

.3 Provide proper implements, tools and facilities approved by the Engineer, for the safe and convenient prosecution of the Work.

.4 Take every precaution to prevent foreign material from entering the pipe.

3.2 TRENCHING AND BACKFILLING

.1 Provide trenching, excavating, and backfilling to Section 31 23 10.

3.3 PIPE BEDDING

.1 Place bedding depth indicated.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior, including spading under the pipe haunches. Do not use blocks when bedding pipe.

.3 Shape transverse depressions in bedding as required to make joints.

.4 Carry bedding material horizontally across actual trench width. Mounding bedding material will not be permitted.

.5 After pipe installation place remainder of bedding in layers over pipe to dimensions indicated.

.6 Where gravel bedding is used, install geotextile fabric before placing overtopping bedding.

.7 Compact each layer of bedding to 95% Standard Proctor Density.

3.4 PIPE LAYING

.1 Carefully lower pipe into the trench. Do not drop or dump materials into the trench.

.2 Lay and join pipes, fittings and valves as specified herein and according to manufacturer's published instructions.

.3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
.1 Horizontal Alignment: 50 mm.
.2 Vertical Alignment: the lesser of 12 mm or one half the rise per pipe length.

.4 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.

.5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary water-tight bulkheads when pipe laying is not

in progress.

.6 Do not lay pipe when the trench bottom is frozen, underwater or when trench conditions or weather are unsuitable.

3.5 PIPE JOINTING

.1 Install gaskets in accordance with manufacturer's published instructions. During cold weather store gaskets in heated area to assure flexibility.

.2 Align pipe carefully before joining. Do not use excessive force to join pipe sections.

.3 Support pipes as required to assure concentricity until joint is properly completed.

.4 Keep pipe joints free from mud, silt, gravel or other foreign material.

.5 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.

.6 Where deflection at joints is permitted, deflect only after joint is completed. Do not exceed maximum joint deflection recommended by manufacturer.

.7 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer.

.8 Make watertight connections to manholes and structures.

.9 At structures provide flexible joint not more than 300 mm from outside face of structure, or as otherwise indicated.

3.6 PIPE BACKFILL

.1 As specified in Section 31 23 10.

3.7 PIPE CLEANING

.1 Prior to testing, clean gravity sewer to remove foreign materials.

3.8 TESTING SANITARY GRAVITY SEWER

.1 Tests for PVC sanitary sewers:

.1 All PVC sanitary sewers including services shall be tested for watertightness by an air test after backfilling.

.2 The test shall be conducted between two consecutive manholes.

.3 The test section shall be plugged at each end with one of the plugs equipped for the air inlet. All services, stubs and fittings into the sewer test section shall be properly capped or plugged and braced to prevent leakage.

.4 The air control equipment shall consist of valves and pressure gauges used to control the air entry rate and to monitor the air pressure. The air Control equipment shall include a shut-off valve, pressure regulating valve, pressure reduction valve and a monitoring pressure gauge having minimum divisions of 69 KPa and accuracy of .28 KPa.

.5 Air shall be supplied to the test section slowly, filling the pipe until a constant pressure of 24 KPa is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 34 KPa.

.6 When constant pressure of 24 KPa is reached, throttle the air supply to maintain the internal pressure above 21 KPa for a minimum of 5 minutes to permit the temperature of the entering air to equalize with the pipe wall temperature. Check for leakage with a soap solution. If leakage is evident, release the pressure in the line, tighten leaky caps and plugs and repressurize as before.

.7 After a stabilization period, adjust the air pressure to 24 KPa and shut off the air supply. Observe the gauge until the air pressure reaches 20.5 KPa, then commence timing with a stop watch until the pressure drops to 17 KPa. The time required for this pressure loss of 3.5 KPa is outlined in the Unibell Handbook of PVC Pipe, Latest Edition.

3.9 DEFLECTION TESTING - PVC PIPE

.1 Measure deflection by pulling a deflection gauge through each pipe from manhole to manhole after backfilling.

.2 Provide deflection gauges to measure a 5% and 7-1/2% deflection. Gauges to be a "Go-No-Go" device.

.3 Thirty days after installation, pull a deflection gauge measuring 5% deflection through the installed section of pipeline. If this test fails proceed with 7-1/2% deflection test.

.4 Thirty days prior to completion of Warranty Period Maintenance, pull a deflection gauge measuring 7-1/2% deflection through the installed section of pipeline.

.5 If 7-1/2% deflection test fails, locate defect and repair. Retest to satisfaction of Engineer.

3.10 CLOSED CIRCUIT TELEVISION INSPECTIONS

.1 Contractor shall arrange and pay for television camera inspection of installed sanitary pipeline, 200 mm and larger.

.2 Scheduling:
.1 The video inspection shall be first performed when the sanitary sewer has been cleaned and all manhole adjustments and street reinstatement have been completed.
.2 The entire system shall also be video inspected a second time eleven months after substantial completion.

.3 Equipment:
.1 Provide equipment meeting following requirements:
.1 Self-contained monitoring unit and camera with remotely controlled lighting system capable of varying the illumination.
.2 Picture quality shall produce continuous 600-line resolution picture, showing entire periphery of pipe.
.3 A meter device with readings above ground or marking on cable to clearly identify exact location of camera.

.4 Definition of fault:
.1 Any pipe joint which displays a gap or spread, offset, gasket, or signs of infiltration.

.2 Any section of pipeline which is crushed, broken or displays cracks.
.3 Any variance in grade of pipeline.
.4 Any gravel, roots, or foreign material which may impede flow.
.5 Any deformation in shape of pipe.

.5 Inspection:
.1 Perform inspection of pipe by passing TV camera through pipeline in direction of flow.

.6 Records:
.1 Maintain inspection record in log form, during television inspection.
.2 Log to include location of each fault.
.3 Photograph fault and provide hard copy stills directly from system if possible. All photographs to be clear and precise with distinct definition of fault.
.4 Include detailed technical description with photographs as supporting data for each fault.
.5 All photos and videos to be in colour.

.7 Reports:
.1 Provide a composite report of TV inspection. Enclose report in binder on letter size paper. Include following pages and information.
.1 Title page identifying project, camera operator and dates of inspection.
.2 Index page identifying pipeline, page number or numbers where information for section is contained.
.2 Report on each pipeline to contain:
.1 Heading:
.1 Street name.
.2 Manhole numbers applicable to section.
.3 Reference drawing number, if applicable.
.4 Weather on the day of inspection.
.5 Statement of soil condition in area of inspection, i.e., dry, damp, wet, frozen.
.6 Date of inspection.
.2 Key Plan showing magnetic north, horizontal distance, pipe and material and

direction of flow.

.3 Inspection findings for each pipeline to include:

.1 Location of all faults.

.2 One photograph each of typical joint and flanged connection.

.4 Mount photographs on left-hand page and place corresponding description on right- hand page. Number all photographs in order. Number beside photograph to correspond with description number.

.5 Enclose all pages of report in transparent sheet protector.

.6 Provide copy of video tape to Engineer.

3.11 TESTS TO BE REPEATED

.1 Should testing or inspection disclose non-conformance, locate and repair defective pipe or joint to the approval of the Engineer.

.2 Re-test to determine success or otherwise of remedial measures applied to pipework. These re-tests are to be repeated at no extra cost to Contract until results show that remedial measures have been successful.

.3 In the event the Engineer suspects the sanitary gravity sewer no longer complies with requirement of the test, the Engineer may order additional testing. Should the length of pipeline prove defective, the Contractor shall repair or make good the defect at no extra cost to Contract.

.4 Cost of additional testing to be at no extra cost to Contract if test proves a defect. However, if this testing shows pipe to be satisfactory, cost of second test will be borne by Engineer.

3.13 CLEANUP

.1 Upon completion of testing of each section remove all ancillary equipment and plug holes. Do not backfill around test plugs until inspected by Engineer.

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies requirements for constructing submersible pumping stations. Work generally includes supply and installation of pumping equipment, pump controller, valves, metal fabrications, and related pipe work.

1.2 RELATED SECTIONS

.1 Cast-in-Place Concrete: Section 03 30 00

.2 Metal Fabrications: Section 05 50 00

.3 Exterior Water Proofing: 07 11 00

.4 Excavating, Trenching and Backfilling: Section 31 23 10

.5 Forcemains: Section 33 34 00

.6 Sanitary Sewer: Section 33 31 00

.7 Electrical: Division 26

.8 Mechanical: Division 24

.9 FRP Equipment Enclosure: Section 13 34 23

1.3 REFERENCE STANDARDS

.1 ANSI/ASME B-16.1-2005, Class 125, Cast Iron Pipe Flanges and Flanged Fittings.

.2 ANSI/AWWA C104/A21.4-08, Cement Mortar Lining for Ductile-Iron Pipe and Fittings.

.3 ANSI/AWWA C110/A21.10-08, Ductile-Iron and Gray Iron Fittings for Water.

.4 ANSI/AWWA C151/A21.51-02, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.5 ASTM A36M-08, Carbon Structural Steel.

.6 ASTM A181M-06, Carbon Steel Forgings for General-Purpose Piping.

.7 CAN/CSA-C22.1-06, Canadian Electrical Code.

.8 CAN/CSA-C22.2 No. 108-01, Liquid Pumps.

.9 CSA Bulletin S2619-1998, Information and Documentation.

.10 National Fire Protection Association.

.11 Stratford Utility Corporation Municipal Services Standards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate details of piping, valves, supports, pumps, metal fabrications, access hatches, and appurtenances.

1.5 OPERATING AND MAINTENANCE DATA

.1 Provide operating and maintenance data in accordance with Section 01 78 00 and as follows:
.1 System description.
.2 Design parameters, system hydraulics, design calculations, and system curves.
.3 Performance curves for the pumps, layout, and wiring diagrams, control system schematic, level control system schematic.
.4 Related civil, mechanical, and electrical drawings.
.5 Manufacturer's operation instructions.
.6 Name, address, and telephone number of equipment suppliers.
.7 Information on guarantees and warranties.

1.6 HANDLING AND STORAGE

.1 Handle and store pumps, pipe, valves, and fittings in such a manner as to avoid shock and damage. Do not use chains or cables passed through pipe or equipment. Do not damage coatings OR linings.

1.7 MAINTENANCE MATERIAL

.1 Provide manufacturer's recommended spare parts list.

.2 Manufacturer's local representative to maintain, in local inventory, spare parts per item .1 above. Parts to be available for shipment within 24 hours notice.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Pumps: Flygt NP 3153 SH, 17.2 kW (23 HP) pump Curve No. 276). Duty point as per drawings.

2.2 PUMPS

.1 Sealed submersible, non-clog type impeller.
.1 Equip each pump with submersible, electric motor complete with power supply and monitoring cable(s). Pumps shall be suitable and labelled accordingly for operation in a Class 1, Zone 1, Hazardous area.

.2 Pump unit to be capable of delivering flow and TDH, as indicated per level B of Hydraulic Institute Standard for Centrifugal Pumps. Pump and motor shall be sized that the motor will not operate in the service factor area at any point on the performance curve.

.3 Supply each unit complete with a mating, cast iron discharge connection and galvanized lifting chain or cable, approved for overhead lifting and of adequate strength to permit raising and lowering of the pump. See drawings for lifting system.

.4 Pump and motor close-coupled, integral design capable of handling raw, unscreened sewage. Discharge connection elbow to be permanently installed in wet well, together with the discharge piping.

.5 Pump to be automatically connected to discharge connection elbow when lowered into place, and easily removed for inspection and service.

.6 Major pump components: grey cast iron, with smooth surfaces, devoid of blowholes and other irregularities.

.7 All exposed nuts and bolts to be 316 series stainless steel construction.

2.2 PUMPS (Cont'd)

.8 Protect all surfaces coming into contact with sewage, other than stainless steel or brass, by a two-part oxirane ester Duasolid 50 paint. The total layer thickness should be at least 120 microns. Zink primers shall not be used.

.9 Machine all mating surfaces where watertight sealing is required and fitted with nitrile or neoprene rubber O-rings. Accomplish sealing by metal-to-metal contact between machined surfaces.

.10 Control compression of nitrile rubber or neoprene O-rings without the requirement of a specific torque limit. Do not use secondary sealing components, rectangular gaskets, elliptical O-rings, grease or other devices or materials.

.11 Volute: single port, non-concentric design with smooth fluid passages, large enough at all points on the volute to pass any size solids which can pass through impeller.

.12 Impeller hard iron dynamically balanced, non-clog design having a long throughlet without acute turns.
.1 Impeller to be capable of handling solids, fibrous material, heavy sludge, and other matter found in normal sewage applications.

.13 Wear plate system to provide efficient sealing between volute and impeller, and consist of a stationary hard metal wear system, which is fitted to volute inlet.

2.3 CABLE

.1 Power and/or control (monitoring) cable(s): neoprene-jacketed type SOW composite cable sized to meet or exceed electrical code requirements. Cable to be suitable for submerged use and CSA approved.

.2 Provide cables in sufficient length to run directly to the junction box.

2.4 CABLE ENTRY

.1 Cable entry design shall ensure an impermeable seal.

.2 Cable entry to be comprised of a cylindrical elastomer grommet system or an epoxy sealed cable entry system.

.3 Cable entry design shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 20 m.

2.5 GUIDE BARS AND CABLES

.1 Provide corrosion resistant vertical guide bar(s) with each pump to ensure correct alignment of pump with automatic discharge connection.

.2 For each pump, guide bar(s) to be as specified in the Project Documents, securely fixed at lower end to the discharge connection by means of corrosion proof bosses, provided.

.3 Extend guide bar(s) from discharge connection toward ground level to be securely fixed by a corrosion proof bracket (upper guide bar holder), anchored to the station roof.

.4 Provide bracket with special inserts to position the guide bars rigidly, where applicable.

2.6 DISCHARGE CONNECTIONS

.1 Provide cast iron, automatic discharge connection for each pump to connect pump to discharge piping.

.2 Discharge connection to be permanently fixed in position by anchor bolts attached to the bottom of the pump chamber.

.3 Discharge connections to permit rapid and precise installation or removal of the pumps without entering pump chamber.

.4 Connection to ensure zero leakage between the pump and its discharge connection.

2.6 DISCHARGE CONNECTIONS (Cont'd)

.5 No part of the pump shall bear directly on the floor of the wet well.

2.7 WET WELL FLUSHING

.1 The station shall have one flush valve that flushes the wet well every second pump cycle. The flush valve shall be Flygt Model 4901 or approved equal.

2.8 PIPING, FITTINGS AND VALVES

.1 Pipe: all interior station piping to be ductile iron Special Class 54 or as specified in the Project Documents.

.2 Welded fittings: to ASTM A181.

.3 Flanges to ANSI/ASME B-16.1, Class 125.

.4 Wall penetrations: all wall penetrations to have modular seals, Linkseal, Pen-seal or approved equivalent. Exterior wall pieces to be cement-lined ductile iron with pipe ends as indicated on Drawings. Exterior connections to forcemain to be by suitable coupling with joint restraint.

.5 Install check valves and plug valves as specified in each pump discharge line in a separate service enclosure. Each valve to have a throughway size equal to the pump discharge pipe size to ensure full, free-flow operation.

.6 Check Valves:

.1 Full body swing type check valve. Valve shall be rated for 1735 kPa working pressure. Body shall be ductile iron (ASTM A-536) with Buna-Nreinforced disk, 125 lbs flanged connections and visual disk indicator.

.1 Swing-flex check valves with visual disk indicator by Val-matic Series 500 are an acceptable alternative.

2.8 PIPING, FITTINGS AND VALVES (Cont'd)

.7 Plug Valves:

.1 Non-lubricated eccentric plug type, cast iron body to ASTM A126, Class B, with exterior epoxy finish and BUNA-N interior coating; full round port, wrench operated with 125 lb. flanges.

.1 Acceptable products: Keystone Ballcentric, or approved equal.

.8 Air Release Valves:

.1 Pressure type short bodied sewage air release valve complete with back flush attachments designed for use on a wastewater system. Inlet connection to be 50 mm NPT, epoxy fusion coated (interior) cast iron body, 316 stainless steel trim.

.2 Acceptable products: Golder Anderson Fig. 929 or approved equivalent.

2.9 MOTOR

.1 The pump motor: squirrel-cage induction type design, housed in a watertight chamber of maximum efficiency and durability. Design motor for continuous duty capable of sustaining a minimum of thirty (30) starts per hour. Motor speed and electrical characteristics as indicated in Project Documents.

.2 Motor stator: directly shrink-fitted into the stator housing. Insulate stator winding and leads with moisture-resistant varnish capable of withstanding a temperature of 180°C or the motors maximum temperature rise, whichever is greater. Insulation rating to Class H.

.3 Rotor bars and short-circuit rings to be made of aluminum. Use thermal sensors to monitor stator temperatures on all pumps. Equip stator with not less than two (2) thermal switches embedded in the end coils of the stator windings (one switch per phase to protect the motor against surcharges and high temperature). Use these in conjunction with, and supplemental to, external motor overload protection, and wired to the control panel.

2.9 MOTOR (Cont'd)

.4 Equip motor housing with a moisture detector to detect any leakage of water or pumpage, into the stator housing. The signals from the thermal switches and the moisture detector to be wired to the control panel.

.5 Accomplish control of the moisture detector and the winding thermal switches by using a control/indicator relay(s) which will be installed and wired inside the control panel to stop the pump unit upon a fault signal.

.6 Motors to be air cooled to manufacturer's standard.

.7 Motor shall be able to operate dry without damage while pumping under load.

2.10 SHAFT AND SEALS

.1 Pump shaft: AISI 400 series stainless steel. Provide each pump with a tandem mechanical shaft seal system.

.2 The upper of the tandem set of seals operates in a cooling medium. This set contains one stationary ring and one positively driven rotating ring. The seals function as an independent secondary barrier between the pumped liquid and the stator housing.

.3 The lower of the tandem set of seals shall function as the primary barrier between the pumpage and the stator housing. This set shall consist of a stationary ring and a positively driven rotating ring. Seals to be solid tungsten carbide, silicone carbide or carbon ceramic.

2.11 ACCESS FRAME AND COVER

.1 Aluminum access frame to be fabricated using an extrusion of 6351 aluminum. Cover to be fabricated using a plate of 5086 aluminum designed to withstand shear and deflect not more than 1/79 of the maximum span for minimum specified loads of 7.2 kPa uniform load or 1100 kg point load. The cover is to rest on a rubber gasket to be hinged along one side with a heavy duty aluminum hinge.

2.11 ACCESS FRAME AND COVER (Cont'd)

.2 Top of the access frame to be flush, the handle recessed. Install padlock within the recess to lock the cover in the closed position.

.3 Provide cover stay to allow the cover to be locked in the open position.

.4 Each access frame to be capable of supporting the full weight of any submersible pump which can be installed through its opening.

.5 Design access frames for embedding into the concrete top of a sewer station, extrusion to be shaped such as to provide good anchoring to the concrete. All surfaces in contact with the concrete to be bitumastic coated.

.6 Frames to be capable of being installed side-by-side by bolting them together using standardized bolting kits.

.7 Provide aluminum rail nuts within the extrusions, permitting an upper guide holder, a level regulator hanger and a chain hook to be attached without any modifications required to the frame.

.8 A bilingual confined space warning label to be clearly displayed on the underside of the cover.

.9 Provide a safety grate for fall through protection. When installed in pairs, safety grates should open outward unless specified otherwise in the contract documents.

2.12 WET WELL VENTILATION

.1 Wet well mounted air supply type fan, complete with remote fan control board for installation in pump control panel, 8 m remote panel cable, suitable for use in a Class 1, Zone 2 environment as indicated on the drawings.

.1 Acceptable product: Dexon SMDV2 or approved equivalent.

2.12 WET WELL VENTILATION (Cont'd)

.2 Vent pipe to be XFR DWV PVC, with socket welded flanges and located as per the project drawings. Coordinate fan and ventilator connections.

2.13 MISCELLANEOUS ITEMS

.1 Baffle: fabricated from stainless steel to ASTM A36.

2.14 LIQUID CONTROL

.1 See specification Section 26 90 00.

2.15 PUMP CONTROL PANEL

.1 See specification Section 26 90 00.

2.16 ELECTRICAL WIRING

.1 Install only equipment essential for the operation of the pump station inside the wet well.

.2 Locate, where possible, all fans, heaters, switches and junction boxes, etc., outside the wet well to avoid corrosion or flood damage.

.3 All electrical wiring of the pump station to be designed and supplied by the manufacturer in accordance with the Canadian Electrical Code and CSA bulletin S2619.

.4 Provide pump power and level regulator cables in sufficient length to run directly to the control panel via an external conduit. Provide conduit fittings and strain relief connectors in sufficient number and size to permit installation of the conduit to the pumping station. All external conduits to enter the control panel enclosure only through the bottom. Seal conduits with an approved gastight barrier, preventing entry of vapour or gas from the wet well into the control panel. Locate seal to enable motor removal complete with electrical disconnect without disturbing the seal. Where EYS seals are used, a rated junction box is to be employed to allow for pump removal.

2.16 ELECTRICAL WIRING (Cont'd)

.5 Code all wiring in the pump station either by colour or a numbering system.

.6 Provide pump power and level regulator (and automatic flush valve-optional) cables with sufficient length to run directly to the junction box (except where otherwise specified), and pull through external conduits.

2.17 INSPECTION, TESTING AND SHIPMENT

.1 Inspection and Testing

.1 Test pump proper operation at rated power supply values and for electrical and mechanical integrity prior to shipment. Pump supplier to have adequate test facilities to at least provide a single-point performance test or a complete performance curve at an accuracy of ± 1%. Check level regulators for correct operation.

.2 Pump/motor assembly to be CSA approved as one, integral unit, as per CSA standard CAN/CSA-C22.2.108. Proof of this approval to be submitted by the pump manufacturer together with the approval drawings. An approval of the motor unit only shall not be acceptable. Cable to be CSA approved, SOW type, neoprene-jacketed, with a 90°C rating.

.3 The supplier grants the right of inspection of the pumping equipment to any authorized representative of the purchaser or Owner's representative before shipment from factory. If inspection is requested give 48 hours notice in advance of the time when the equipment will be ready for inspection at the factory. The Owner will pay the costs associated with having an Owner's representative observe the testing.

.4 Any equipment in the pumping station that may have been provided by another supplier shall have been tested by the original supplier.

.5 Pump manufacturer to perform the following inspections and tests on each pump before shipment:

.1 Check impeller, motor rating, and electrical connections for compliance to the customer's purchase order.

2.17 INSPECTION, TESTING AND SHIPMENT (Cont'd)

.1 (Cont'd)

.5 (Cont'd)

.2 A motor and cable insulation test for moisture content and/or insulation defects.

.3 Prior to submergence, run the pump dry to establish mechanical integrity and free rotation.

.4 Run pump for 30 minutes, submerged 2 m minimum depth.

.5 Repeat after operational test number 4, the insulation test, number 2.

.6 Check oil housing for any leakage of water by the lower seal.

.7 Inspect motor housing and junction box for any water leakage.

.8 Supply upon request, a written report stating that the above tests have been performed with each pump at the time of shipment.

.9 Seal pump cable end with a high quality protective covering to make it impervious to moisture and/or water seepage, prior to shipping to job site and electrical installation.

.6 Provide successful test results prior to shipment.

.7 Shipment

.1 Ship equipment assembled to the greatest extent possible to reduce installation and start-up costs.

2.18 LABELS

.1 Suitable nameplates to be permanently affixed onto the pumps, motors, control enclosure components, and other operating components to indicate the purpose of the component or operating routine and parameters applying to the component. The lift station pumps and control equipment are CSA approved and the CSA logo appears on the nameplates of these components.

.2 Provide a second complete set of pump data and serial number labels for the Owner's reference.

2.19 PAINTING

.1 Paint all station pipe work unless it is stainless steel.

.2 Paint products by Glidden/Devoe and Pittsburg Paint Ltd. (PPG) or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL

.1 Verify all layouts, dimensions, elevations and other pertinent data prior to proceeding with the work.

.2 Back-prime all metal surfaces being mounted directly against concrete surfaces with bitumastic paint with the exception of surfaces that will be grouted in.

.3 Examine all components to be incorporated into the Work for cracks, pits, blow holes, finishes, and any other defects. Do not incorporate any defective materials into the Work. Remove any defective materials from the site immediately and replace defective materials with new materials. Inspect all materials and remove all dirt and other debris.

.4 Install all components in strict accordance with each manufacturer's instructions, recommendations and the approved shop drawings for the various materials to be incorporated in the Work.

.5 Install pumps, pipe, fittings, valves, accessories and appurtenances using skilled workers experienced in the tasks required.

.6 Handle all components carefully taking care not to damage the surface finish on these components. Make good any damage or supply new components as appropriate.

.7 Install isolation bushings between stainless steel anchors and other dissimilar materials.

3.1 GENERAL (Cont'd)

.8 Install stainless steel washers when installing anchors for pump discharge base elbows. Washers to have a stick-on plastic film on the side contacting the base elbows. Use stainless steel shims similarly protected when shimming base elbows.

.9 Arrange for start-up, testing and commissioning by the equipment manufacturers' representatives in presence of the Owner's representatives after the installation has been completed and is ready for start-up and commissioning.

.10 All electrical installations to be completed to meet or exceed all applicable codes.

3.2 PIPING

.1 Cut piping to length using equipment designed for the cutting of pipe within the maximum allowable tolerance from square cut ends in accordance with type.

.2 Lubricate pipe and gaskets with lubricant before installing gaskets on pipe and completing joint.

.3 Install piping straight, parallel to walls and in such a manner so as to prevent straining during jointing procedures. Install galvanized pipe supports where shown or required.

.4 Prior to assembling flanged joints, thoroughly clean flanges. Use a gasket lubricant to ease gasket installation. Tighten diametrically opposed bolts simultaneously.

.5 Do not correct misalignment using fasteners or other means to pull flanges into alignment. Correct so that no eccentric loads are placed on flanges.

3.3 VALVES

.1 Ensure that the valves are installed in the proper orientation with respect to flow direction. Install isolation valves with the seat side towards pump.

3.3 VALVES (Cont'd)

.2 Ensure that all valves are installed in waterproof chambers with access for maintenance or as specified in the project documents.

3.4 PUMPS AND APPURTENANCES

.1 Locate, align, level, adjust and install pump discharge base elbows. The pumps and discharge base elbows to be located so that the pumps can be easily removed through the openings in the lift station without requiring the removal of any station equipment. Ensure that sufficient clearance is present to permit easy pump removal when a flush valve is installed on the designated pump.

.2 Install upper guide bar or cable holders and guide bar(s) or cables in accordance with the pump and anchor manufacturer's instructions, so that the guide bars are true, plumb and in the proper location and alignment so that the pumps can be easily removed through the openings in the lift station cover.

.3 Take particular care to protect the finish on the pumps, pipe, fittings, valves and appurtenances from scratches and other damage. Repair any damage to the surface finishes.

3.5 ACCESSORIES

.1 Level regulator hanger to be constructed of galvanized steel and mounted in the position indicated or as directed by the Engineer. The level regulator hanger(s) shall otherwise be mounted in a location where the will not be affected by flow from the inlet piping or prevent removal of the pumps, including a pump if fitted with flush valve, all in accordance with the pump and anchor manufacturer's instructions.

3.5 ACCESSORIES (Cont'd)

.2 Back-prime and mount each galvanized chain hook or cable in the area shown and located so that the chain can be reached conveniently and such that the hook does not interfere with pump removal from the lift station. Install isolation bushings between galvanized steel and 316 stainless steel anchors. Install hooks in accordance with pump and anchor manufacturer's instructions.

.3 Supply and install back-primed galvanized pipe supports and install with medium duty, 316 stainless steel, wedge anchors using isolation bushings all in accordance with the anchor manufacturer's instructions.

.4 Following installation of the stainless steel anchors that use studs instead of bolts, cut the studs off level with the top of the nut.

3.6 TESTING

.1 Test interior pipework: water inside pipework to be gradually increased until it reaches a minimum of 690 kPa and maintain test pressure for one hour. No leakage will be allowed.

.2 Prior to starting the pumps, remove the plug or cap from the forcemain in the manhole.

.3 After pumps and piping have been installed, test pumps with the material they are to pump, or with water, operate and pump for a duration of time sufficient to satisfy that the complete installation has been properly installed and aligned and that the pumps run free from heating, rubbing or vibration and meet the requirements of these Specifications, and that the pumps and piping are free and clear of debris and obstructions.

.4 Demonstrate that each pump can be easily removed from the lift station without obstruction or removal of any station equipment. Make any adjustments necessary to carry out pump removal in this manner.

3.6 TESTING (Cont'd)

.5 Demonstrate the operation of all valves and make any adjustments necessary to permit the valves to be operated smoothly without obstruction and allow the pumps to be removed with the valves in an open or closed position.

.6 Demonstrate integrity of pump discharge connection seal to pump by pumping down wet well sufficiently to detect leakage.

.7 Observe wet well and valve chamber piping during pump operation for leaks and/or loose connections. Repair any leaks identified.

.8 Station piping to be tested in accordance with Section 33 34 00, Clause 3.8.

3.7 PAINTING

.1 All paint applications and methods to be done in strict accordance with recommendation of the applicable CGSB Standards. Manufacturer's instructions are subject to the approval of the Engineer.

.2 Do not paint when temperature is below 10°C.

.3 Do not paint nameplates.

.4 Remove from surfaces grease, oil, dirt, dust, ridges and other soil and materials that would adversely effect the adhesion or appearance of finish coatings.

.5 Touch up shop primer or paint with same type as originally used.

.6 Formula for ductile iron piping coated with manufacturer's asphalt sealer:
.1 One (1) coat BIN pigmented white shellac sealer.
.2 Two (2) coats semi-gloss enamel CAN/CGSB-1.59 (medium grey in colour PPG 506-4).

.7 Formula for exterior galvanized and zinc coated ferrous metals, including access hatches:

.1 One (1) coat galvanized sheet primer CAN/CGSB-1.213 (Devoe 4120, PPG 97-687).

.2 Two (2) coats semi-gloss enamel CAN/CGSB-1.59 (medium grey in colour PPG 506-4).

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This section specifies the requirements for construction force mains. Work includes supply, installation and testing of pipe, fittings and relates appurtenances.

1.2 REFERENCES

.1 American National Standards Institute /American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C104/A21.4-[16], Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

.2 ANSI/AWWA C111/A21.11-[17], American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.

.3 ANSI/AWWA C110/A21.10-[12], American National Standard for Ductile-Iron and Gray Iron Fittings for Water.

.4 ANSI/AWWA C153/A21.53-[19], Standard for Ductile-Iron Compact Fittings.

.5 ANSI/AWWA C500-[19], Standard for Metal-Seated Gate Valves for Water Supply Service.

.6 ANSI/AWWA C600-[17], Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.

.7 ANSI/AWWA C800-[14], Standard for Underground Service Line Valves and Fittings.

.8 ANSI/AWWA C900-[16], Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300mm),for Water Transmission and Distribution.

.2 ASTM International

.1 ASTM A 307-[10], Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.2 ASTM B 88M-[09], Standard Specification for Seamless Copper Water Tube [Metric].

.3 Stratford Utility Corporation Municipal Servicing Standard

1.3 RELATED REQUIREMENTS

.1 Cast-in-Place Concrete: Section 03 30 00

.2 Excavating, Trenching and Backfilling: Section 31 30 00

.2 Sewage Lift Station: Section 32 32 13

.3 Submersible Pumping Station: Section 32 32 13

.4 Sanitary Sewer: Section 33 31 00

.5 Precast Structures: Section 33 39 00

.6 Reinstatement: Section 32 98 00

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide Consultant at least 4 weeks prior to beginning Work, with proposed source of bedding materials and provide access for sampling.

.3 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work in accordance with Section 01 33 00 - Submittal Procedures.

.4 Certification to be marked on pipe.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Polyvinyl chloride (PVC) pipe: to AWWA C900
.1 Pressure Class: Class 165.
.2 Gasket bell end.
.3 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to ANSI/AWWA C111/A21.11, with transition gaskets to pipe manufacturers specifications.
.4 Rubber gaskets: to ANSI/AWWA C111/A21.11.
.5 MJ fittings to AWWA C153 cement mortar lined to AWWA clay and coated outside with standard coating.
.6 PVC fittings: to AWWA C907 and certified to CSA Standard B137.3.

.2 Molecularly Oriented Polyvinyl chloride (PVCO) pipe: to AWWA C909
.1 Pressure Class: Class 235
.1 Gasket bell end.
.2 Pipe joints: bell and spigot with rubber gaskets solvent welded joints or mechanical joints to ANSI/AWWA C111/A21.11, with transition gaskets to pipe manufacturers specifications.
.3 Rubber gaskets: to ANSI/AWWA C111/A21.11.
.4 MJ fittings to AWWA C153 cement mortar lined to AWWA clay and coated outside with standard coating.
.5 PVC fittings: to AWWA C907 and certified to CSA Standard B137.3

2.2 GATE VALVES

.1 Standard buried type: to AWWA C509 up to and including 300 mm, minimum working pressure rating 1380 kPa and as follows:
.1 Body: cast-iron with mechanical joint ends.
.2 Mechanism: solid resilient wedge, epoxy coated, bonnet, S.S., packing gland nuts and bolts, non-rising spindle, and O-ring seals.
.3 Direction to close: clockwise.
.4 Operating nut: 50 mm square.
.5 Acceptable products:
.1 Clow McAvity F-6100 Resilient Seat Valve
.2 Mueller A2360-23 Resilient Wedge Valve
.3 AVK Series 25/00 Resilient Seat

.2 Epoxy coat all gate valves with minimum 150 microns coating.

2.3 VALVE BOXES

.1 To AWWA C500 and as follows:
.1 Two piece sliding type with cover and centering disc, adjustable for depth of pipe below finished grade.
.2 Covers marked "Sewer".
.3 Lugged to prevent turning and rolling of cover, and cover notched to suit.
.4 Have clear opening of 135 mm.
.5 Bonnet on the bottom section which is capable of enclosing the packing gland section of the gate valve.
.6 Acceptable products:
.1 Mueller MVB composite valve box.

2.4 BOLTS FOR BURIED SERVICE

.1 T-head bolts and nuts:
.1 Low alloy Corten steel

2.5 AIR RELEASE VALVE

.1 Service Saddle: Brass to AWWA C800
.1 Acceptable Products:
.1 Mueller H13000

.2 Corporation Stop: Brass to ASTM B62, CC x FIP Threads to AWWWA C800, minimum pressure rating of 1035 kPa.
.1 Acceptable Products:
.1 Meuller H10045

.3 Stainless Steel Pipe: Schedule 10 304L Stainless to ASTM A240, Threaded

.4 Air release Valve: Pressure type air release valve for use on a waste water system. Inlet connection to be 50mm NPT, Epoxy Fusion coated (Interrior), cast iron body 316 Stainless Steel trim.
.1 Acceptable Products:
.1 Valmatic VMC-48
.2 Golden Anderson Fig.925

2.6 COUPLINGS

.1 Mechanical joint sleeve type: to AWWA C110; use on new ductile iron pipe. Provide spacer ring between pipe ends. Where gap between pipe ends is less than 10 mm, spacer not required.

2.7 THRUST RESTRAINT

.1 Thrust blocks and anchors: Minimum 25 mpa compressive strength.

.2 Joint restraint device: 100 mm to 600 mm joint restraint device to AWWA C111 and C153 for mechanical or push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 2410 KPa and minimum safety factor of 2:1. No special tools shall be required for installation.
.1 Acceptable products:
.1 Ebaa Iron Megalug
.2 Clow
.3 Sigma
.4 Uni-Flange

2.8 PIPE BEDDING AND SURROUND MATERIALS

.1 Sand bedding material: to Section 31 23 10.

2.9 INSULATION

.1 Rigid polystyrene insulation to CGSB-51.20, type 4, minimum compressive strength 41.5 KPG (60 psi)Standard of Acceptance: H160 by Dow Chemical Canada.

2.10 MARKER TAPE

.1 Underground warning tape: minimum 75 mm wide, metal detector warning tape, clearly marked "Caution - Buried Forcemain Line" colour red.

2.11 ANODES

.1 #12 Zinc anodes to ASTM B-418, Type 2 Zinc.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Pipes and fittings to be clean and dry.

.2 Prior to installation, obtain Consultant's approval of pipes and fittings.

3.2 TRENCHING

.1 Do trenching Work, in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.

3.3 BEDDING

.1 Place bedding in unfrozen condition.

.2 Place bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95% corrected maximum dry density.

.6 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.4 INSTALLATION

.1 Avoid damage to machined ends of pipes in handling and moving pipe.

.2 Maintain grade and alignment of pipes.

.3 Align pipes carefully before jointing.

.4 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.5 Support pipe firmly over entire length, except for clearance necessary at couplings. Do not use blocks to support pipe.

.6 Keep pipe and pipe joints free from foreign material.

.7 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Remove disturbed gaskets clean, lubricate and replace before jointing is attempted.

.8 Support pipes using hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.9 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.

.10 Apply restraint to pipe to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Consultant.

.11 When stoppage of Work occurs, block pipe as directed by Consultant to prevent creep during downtime.

3.5 VALVES AND VALVE BOXES

.1 Install valves at locations indicated. Joints and bedding as specified for pipe and fittings.

.2 On direct buried valves, install valve boxes plumb and centered over operating nut, and true to line and grade.

.3 Install Anode on valves to manufacturers recommendation.

.4 Place select backfill material, maximum size 50 mm around valve box to subgrade.

.5 When valves are installed with cover in excess of 2.0 m, provide a valve stem extension.

3.6 THRUST BLOCKS

.1 Restrain bends, tees and fittings by concrete thrust blocks as indicated.

.2 Keep pipe couplings free of concrete.

.3 Bearing area of thrust blocks to be as indicated.

3.7 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

.3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 150 mm compacted thickness as indicated.

.4 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.

.5 Compact each layer from mid height of pipe to underside of backfill to at least 95% corrected maximum dry density.

3.8 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.

3.9 LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic test.

.2 All mains and other appurtenances shall be included in the system test.

.3 Perform tests in presence of the Engineer or his representative.

.4 All valves must be pressure tested.

.5 Open all valves in test section.

.6 Expel air from main by slowly filling with potable water. Install corporation stops at high points where no air-vacuum release valves are installed.

3.10 PIPEWORK

.1 Test pipework after backfilling.

.2 Ensure all air release valves on section being tested are installed and operational before testing. Fill watermain, for testing. Pipeline to remain filled for not less than 24 hours prior to pressure test. Ensure all air is purged before starting pressure and leakage tests.

.3 Gradually increase water pressure inside pipe until it reaches 690 kPa at the lowest location under test. Maintain pressure test for two hours.

.4 Measured leakage of water as measured by a water meter approved by the Consultant.

$Qm = (LDP^{1/2})/795,000$

Where: Qm = allowable leakage, in litres/hr.
L = length of pipeline in metres to a maximum of 400m
D = diameter of pipe in millimetres
P = average test pressure in kilopascals

.5 The allowable leakage shall not be exceeded between adjacent valves.

.6 Replace, at no cost to Contract, all pipes, valves, fittings and couplings which are defective. Perform test at no cost to Contract until pipeline is approved by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Excavating, Trenching and Backfilling: Section 31 23 10

.2 Sanitary Sewer: Section 33 31 00

.3 Storm Sewer: Section 33 42 13

.4 Submersible Pumping Station: Section 33 32 16

.5 Watermains: Section 33 11 00

1.2 REFERENCES

.1 ASTM C478M-2009, Specification for Precast Reinforced Concrete Manhole Sections.

.2 ASTM C858-2019, Standard Specification for Underground Precast Concrete Utility Structures.

.3 ASSTM C 1244, Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure test.

.4 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet for use in Building construction.

.5 CAN/CSA-A23.1-04/A23.2-09, Concrete Materials and Methods for Concrete Construction.

.6 CAN/CSA-A3000-2008, Cementitious Materials.

.7 Stratford Utility Corporation, Municipal Servicing Standards, Latest Edition.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Submit manufacturer's test data and certification that materials meet requirements of this section. Include manufacturer's drawings, information, size of components, dimensions and details where pertinent.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Precast wet well, air release chamber, manhole and catch basin sections: to ASTM C478M, circular. Manhole top sections shall be eccentric cone type where identified on Drawings. Precast concrete bases to be approved by Engineer.

.2 Joints:
.1 To be made watertight using rubber O-rings or bitumineus gaskets.
.2 To be made water tight with a single component hydrophobic flexible sealant on sanitary structures from the cone to the frame.

.3 Mortar:
.1 Cement: to CAN/CSA-A3000.

.4 Adjusting rings:
.1 Precast concrete, to ASTM C478.
.2 Flexible synthetic for sanitary structures of less than 75 mm.

.5 Frames and 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.
.3 Bearing surfaces to be ground to eliminate surface imperfections.
.4 Manhole frames and covers: heavy duty municipal type for road service and as indicated on the drawings.
.1 Acceptable product: IMP Group Ltd. Type C56

.6 Catch basin frames and grates: IMP R-11.

.7 Air release Chamber Frame and Core: IMP R-12

.8 Gravel bedding material: as specified in Section 31 23 10.

.9 Waterproofing Membrane: self-adhesive SBS modified bitumen sheet membrane with cross laminated polyethylene film with manufacturer

recommended primer.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILLING

.1 Provide excavating and backfilling in accordance with Section 31 23 10.

.2 Obtain approval of Engineer before installing, manholes or catch basins.

3.2 CONCRETE WORK

.1 Do concrete work in accordance with Section 03 30 00.

.2 Position metal inserts in accordance with dimensions and details as indicated.

3.3 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete manholes and catch basins as pipe laying progresses.

.3 Dewater excavation as directed by Engineer and remove soft and foreign material before placing concrete base.

.4 Set precast concrete base on 150 mm minimum of granular bedding compacted in accordance with Section 31 23 10.

.5 Set riser sections on precast base and make joint watertight with O-ring gaskets or bituminous gaskets. Grout joints inside and out with hydrophobic polyurethane grout. Only grouting of seams is permitted.

.6 Plug lifting holes with non-shrink grout.

.7 Place stub outlets at elevations and in position indicated. Provide type of gasket connection as indicated.

.8 Install manhole benching where shown on the Drawings using concrete suitable for exposure classification C-2 as specified in CSA-A23.1.

.9 Install frames and covers on applicable top

sections to elevation shown on Drawings or as directed.

.10 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

.11 Apply waterproofing for sanitary manholes, wet well and air release chamber as indicated on drawings.

3.4 SYSTEM CLEANLINESS

.1 Upon manhole adjustment, removal of catchment device and all works associated with restoration around the manhole, the contractor shall provide all testing equipment, labour, incidentals, traffic control, etc., required to undertake an inspection of the system to verify its cleanliness. This inspection must be done in the presence of the Engineer.

3.5 TESTING

.1 Provide labour, equipment and materials required to perform testing.

.2 Notify consultant 24 hours in advance of proposed test. Do test in presence of consultant.

.3 Vacuum test:

.1 Plug all inlet and outlet pipes. Restrain plugs.

.2 Place and seal vacuum tester head to the precast section.

.3 Draw vacuum of 250mm Hg on the manhole and measure the time for the vacuum to drop to 225mm Hg.

.4 Time to be not less than 45, 50, 65, and 80 seconds for manhole diameters of 1050mm, 1200mm, 1500mm, and 1800mm respectively.

.5 For manholes deeper than 6 metres, increase test times by 2 seconds per 300mm of additional manhole depth.

.6 Locate and repair defects if test fails. Retest

3.5 TESTING (Cont'd)

4. Exfiltration test:
.1 Plug all inlet and outlet pipes with watertight plugs.
.2 Fill with water to top of precast sections.
.3 Allow time for initial absorption.
.4 Measure and record volume of water required to maintain level for one hour.
.5 Leakage not to exceed 5.0 litres per hour per 1000mm diameter per 1000mm of height above groundwater.
.6 Locate and repair defects if test fails. Retest using same methodology.
.7 Repair leaks regardless of test results.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Excavating and Backfilling: Section 31 23 10.

.2 Precast Structures: Section 33 39 00.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.2 ASTM C 14M-20, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe.

.3 ASTM C 76M-20, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

.4 ASTM C 443M-20, Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

.5 ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3).

.6 Canadian Standards Association (CSA)

.7 CSA B182.1 and B182.2 for PVC Sewer Pipe, SDR=35.

.8 CAN/CSA-A257 Series-M92, Standards for Concrete Pipe.

.9 Canadian General Standards Board (CGSB).

1.3 SAMPLES

.1 Submit samples in accordance with Section 01 33 00- Submissions/Shop Drawings.

.2 Inform Consultant at least 2 weeks prior to commencing work, of proposed source of bedding materials and provide access for sampling.

1.4 MATERIAL CERTIFICATION

.1 Submit manufacturer's test data and certification at least 2 weeks prior to commencing work.

.2 Certification to be marked on pipe.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Contractor to deliver, store and handle materials in accordance with Product Requirements or DTI standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials as indicated by Consultant.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 PIPE

.1 Concrete Pipe and Fittings:
.1 Reinforced: to ASTM C 76M or CAN/CSA A257.2.
.2 Joints: bell and spigot with flexible rubber gaskets to CAN/CSA A257.3-M.

.2 PVC Pipe and Fittings (300 mm dia. and smaller):
.1 Type PSM polyvinyl chloride, to CAN/CSA-B1800, DR35, complete with Bell and Spigot joints with locked in rubber gaskets.

.3 HDPE Pipe and Fittings:
.1 Double walled HDPE pipe with smooth walled interior and corrugated exterior to 320 Kpa. To CSA B182.6.
.2 Joints: bell and spigot with flexible rubber gaskets.
.3 Connect to catch basins with PVC manhole adaptor.
.4 Acceptable products: Solflo Max by Soleno, Boss 200 by Big "0", ADS N12-ST.

2.2 GRANULAR BEDDING AND BACKFILL

.1 Sand bedding: as specified in Section 31 23 10.

.2 Clear stone bedding: as specified in Section 31 23 10.

PART 3 - EXECUTION

3.1 TRENCHING

.1 Do trenching work in accordance with Section 31 23 10 - Excavating and Backfilling

.2 Obtain Consultant's approval of trench line and depth prior to placing bedding material or pipe.

3.2 BEDDING

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in the dry.

.2 Place minimum thickness of 150 mm of approved granular material on bottom of excavation and compact to minimum 98% maximum density to ASTM D 698.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 25% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Consultant, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.3 BACKFILLING

.1 Place approved backfill material in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.

.2 Compact each layer to 98% maximum density to ASTM D 698 taking special care to obtain required density under haunches.

.3 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

.4 Place clay plug as shown on drawings.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Installation of Cables in Trenches and Ducts: Section 26 05 44.

.2 Excavating, Trenching and Backfilling: Section 31 23 10.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No. 211.2-06(R2016), Rigid PVC Conduit.

.2 Maritime Electric Company Ltd. Underground Standard Document.

PART 2 - PRODUCTS

2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC duct: to CSA C22.2 No. 211.2, with moulded fittings, for direct burial.

.2 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

.3 Rigid PVC 90°, 45°, and 30° bends.

.4 Rigid PVC 5° angle couplings.

.5 Expansion joints where conduits exit ground.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

2.3 CABLE PULLING EQUIPMENT

.1 6 mm stranded polypropylene pull rope, tensile strength 5 kN, continuous throughout each conduit run with 3 m spare rope at each end.

2.4 MARKER TAPE

.1 Plastic warning tape, 50mm wide, clearly marked as follows:

.1 "CAUTION - BURIED ELECTRICAL LINE", coloured red.

2.5 MARKER PLANKS

.1 Pressure treated planks, 50 x 150 mm to LSA 080-15 UC4.1

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install direct buried underground cable ducts in accordance with the requirements of the authorities having jurisdiction.

.2 Install duct in accordance with manufacturer's instructions.

.3 Clean inside of ducts before laying.

.4 Open trench before conduits are laid and confirm no obstructions will necessitate change in grade of conduit.

.5 Confirm full, even support every 1.5m throughout duct length.

.6 Install conduits at elevations and slope ducts with 1:400 minimum slope.

.7 During construction, cap ends of ducts to prevent entrance of foreign materials.

.8 Install Marker tape and planks as indicated.

.9 Pull through each duct mandrel not less than 300mm long and of diameter 6mm 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.

.10 In each duct, install pull rope continuous throughout each duct run with 3m spare rope at each end.

END OF SECTION

Geotechnical Investigation Report

Geotechnical Investigation Report

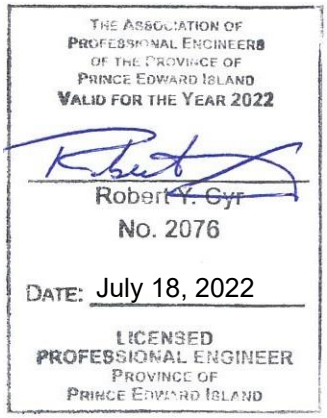
Community Campus Site Servicing

Stratford, PE

CBCL

222617.00 • July 18, 2022

01	Final	R. Cyr	July 18, 2022	D. McKenney
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**



Project No. 222617.00

CBCL
Solutions today | Tomorrow IN mind
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July 18, 2022

Jeannie Gallant
Town of Stratford
234 Shakespeare Drive
Stratford, PE C1B 2V8

Dear Ms. Gallant:

RE: Geotechnical Investigation – Community Campus Site Servicing

Please find below our geotechnical investigation report for the community campus site servicing in Stratford, Prince Edward Island. This report presents our findings and our geotechnical recommendations for foundation design and general site work.

Yours very truly,

CBCL Limited

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Project No.: 222617.00

Contents

Appendices

1 Introduction

CBCL Limited, have conducted a geotechnical investigation for the Community Campus Site Servicing in Stratford, Prince Edward Island. This investigation was conducted at the request of the Town of Stratford, PE. The purpose of this investigation was to evaluate the subsurface conditions throughout the site and to provide geotechnical recommendations for construction and design of the following items:

- Roadways
- Solar Arrays
- Stormwater Detention Ponds
- Pumping Station

This report presents our findings and our geotechnical recommendations for foundation design and general site work within the areas investigated. The heavily treed area at the south end of the site was not investigated due to access constraints. The subsurface conditions in this area should be investigated at a later date.

2 Site Description and Geology

The site is located at Lots 21-1 and 21-2 between Bunbury Road and Hollis Avenue in Stratford, PE. The site mainly consists of grass covered fields (agricultural land); however, a heavily treed area is located along the southern portion of the site. There is a large change in elevation throughout the site with the terrain generally sloping down to the east.

Surficial geologic mapping indicates the principal soil type in the area is glacial till. Bedrock in the area is mapped as sedimentary rock of the Kildares Cape Formation and Wood Islands Member.

3 Summarized Subsurface Conditions

The field program consisted of twenty-five (25) test pits completed on May 25 and 26, 2022. The test pit locations are shown in Drawing 01 in Appendix A.

The test pits were conducted using an excavator. Representative samples were taken during the field work and the conditions at the test pits were logged in detail. The subsurface conditions encountered at the site are described in detail on the appended Test Pit Records and summarized below in the following paragraphs and Table 1.

The subsurface conditions encountered throughout the site generally consist of the following profile:

- ROOTMAT
- REWORKED GLACIAL TILL
- UNDISTURBED GLACIAL TILL
- BEDROCK (INFERRED)

Rootmat was encountered throughout the site and was generally observed to be 150 mm thick; however, its thickness ranged between 120 mm and 400 mm throughout the site.

Reworked glacial till was encountered below the rootmat at all test pit locations with the exception of TP-24. The reworked glacial till layer was observed to be up to 1.4 m thick. It generally consisted of a loose silty sand with gravel and occasional organics overlying a loose clayey sand with gravel to firm sandy lean clay with gravel. Several samples of the reworked till were tested for moisture content. Testing revealed the moisture content ranged between 11.8% and 25.2%, with the higher values generally closer to the surface.

Undisturbed glacial till stratum was encountered throughout the site at depths ranging between 0.3 m and 1.6 m. The till stratum generally consisted of very stiff sandy lean clay with gravel to compact clayey sand with gravel. Occasional cobbles and boulders were generally encountered throughout and increasing in frequency and size with depth. Moisture content testing was conducted on multiple samples and a moisture density relationship test (ASTM D698) was conducted on a composite sample. Testing revealed the moisture content ranged between 12.8% and 21.7%, with an average of 15.5%. Moisture density testing revealed an optimum moisture content of 14.3%.

Bedrock (inferred) was encountered throughout the site at depths ranging between 2.0 m and 4.3 m.

Groundwater was observed within a few test pits at depths between 2.6 m and 4.3 m. Groundwater should be expected to fluctuate seasonally, in response to rain events, construction activity, and/or site use.

Table 3.1: Summary of Findings

Location	Coordinates (m)[1]	Elevation (m)[2]	Thickness of Rootmat (mm)	Thickness of Reworked Till (m)	Depth to Undisturbed Till (m)	Depth to Inferred Bedrock (m)	Groundwater Depth (m)[3]	Depth of Test Pit (m)
TP-01	N 687050.0 E 394062.5	28.6	150	0.4	0.6	2.8	--	2.8
TP-02	N 687054.9 E 394007.3	29.7	150	1.1	1.3	2.9	--	2.9
TP-03	N 686950.9 E 394041.3	31.2	150	1.1	1.3	3.4	--	3.4
TP-04	N 686853.4 E 394094.7	29.7	150	1.4	1.6	2.7	--	2.7
TP-05	N 686744.1 E 394111.0	26.5	150	0.8	1.0	3.4	--	3.4
TP-06	N 686646.9 E 394164.3	21.7	150	0.8	1.0	3.2	--	3.3
TP-07	N 686535.2 E 394163.1	19.2	150	0.6	0.8	2.7	--	2.7
TP-08	N 686424.2 E 394150.2	20.5	150	0.5	0.7	3.6	--	3.6
TP-09	N 686320.2 E 394116.0	23.7	150	0.8	1.0	2.1	--	3.6
TP-10	N 686221.2 E 394163.9	20.0	200	0.6	0.8	2.0	--	3.9
TP-11	N 686113.0 E 394183.3	19.2	200	0.6	0.8	4.0	--	4.0
TP-12	N 686009.7 E 394221.2	17.3	150	0.1	0.3	4.2	--	4.2
TP-13	N 685907.9 E 394179.6	21.7	200	0.5	0.7	3.6	--	3.6
TP-14	N 685782.8 E 394216.4	21.7	150	1.4	1.6	3.3	2.6	3.5
TP-15	N 686267.6 E 394061.7	26.9	200	0.7	0.9	3.7	--	3.7
TP-16	N 686250.4 E 393966.0	32.0	150	0.5	0.7	2.3	--	3.6
TP-17	N 685854.6 E 394175.8	22.9	200	1.2	1.4	3.9	--	3.9
TP-18	N 685852.8 E 394072.4	28.4	150	0.5	0.7	2.3	--	4.5
TP-19	N 685795.9 E 394083.5	28.4	150	0.7	0.9	2.9	--	3.0
TP-20	N 685811.4 E 394182.5	23.1	200	1.3	1.5	4.0	--	4.0
TP-21	N 686567.7 E 394321.6	12.1	120	0.3	0.4	4.3	4.3	4.3
TP-22	N 686426.0 E 394388.1	9.5	300	0.2	0.5	3.3	3.3	3.3
TP-23	N 686215.1 E 394357.2	8.4	200	0.1	0.3	3.4	3.2	3.4
TP-24	N 686184.9 E 394368.8	8.7	400	--	0.4	--	3.3	3.8
TP-25	N 686038.1 E 394294.7	13.3	300	0.5	0.8	4.7	--	4.7

Notes:
[1]Coordinate system PEI Grid NAD83 CSRS.
[2]Geodetic Datum (HTv2).
[3]Measured during excavation.

4 Discussion and Recommendations

Geotechnical recommendations are presented herein for construction and design of the following items:

- Roadways
- Solar Arrays
- Stormwater Detention Ponds
- Pumping Station

The treed portion of the site (south side) was not investigated due to access constraints. The subsurface conditions in this area should be investigated at a later date.

Final details of the proposed development are unknown to us at this time. We should be contacted as the design progresses to allow us to review and adjust our recommendations accordingly.

4.1 Earthworks

4.1.1 Surface Water and Erosion Control

Prior to excavations, surface water drainage controls should be provided on the up-gradient side of the site to minimize run-off onto exposed soils. Suitable erosion and sedimentation control measures should be employed. These may include silt fences, check dams in ditches, and granular working pads.

4.1.2 Excavation

Within the foundation areas for the solar arrays and pumping station, the existing rootmat and reworked till should be removed and reinstated with structural fill, as required.

Where the material encountered at footing base elevation consists of glacial till, we recommend a 300 mm thick layer of Granular Class A or approved granular borrow below the footing.

Within the stormwater detention pond area, the existing rootmat and reworked till should be removed and reinstated with structural fill, as required.

Within the roadways, the existing rootmat and upper portion of the reworked till (with occasional roots/rootlets) should be removed and the subgrade proof-rolled with a

10-tonne steel drum roller. Any excessively weak zones (> 25mm ruts) should be replaced with structural fill.

Inferred bedrock was encountered throughout the site at depths between 2.0 m and 4.3 m. Depending on final grades of the infrastructure, excavation into bedrock may be required in areas.

Test pits located within the foundation and detention pond areas should be re-excavated and reinstated with structural fill. Structural fill should be placed and compacted in lifts to design grade, as required.

The on-site soils could become easily disturbed/softened during construction when exposed to wet conditions or significant traffic. A woven geotextile (such as Terratrack 400) and additional granular material is recommended for construction access roads and travel ways throughout the site. Travel over exposed reworked till or undisturbed till should be minimized.

Temporary excavated side slopes in unsaturated conditions should be stable at one horizontal to one vertical (1H:1V). Saturated slopes should be reviewed by geotechnical personnel during construction.

Stockpiled excavated material should be placed at a distance away from the excavations to ensure the stability of the slopes are not compromised. This should be reviewed by geotechnical personnel during construction.

4.1.3 Dewatering of Excavations

The contractor undertaking the earthworks must be prepared to dewater excavations. Footings should not be placed in standing water, slough, or over softened bearing soils.

Discharge from the dewatering activities must be carried out in strict accordance with environmental regulations. Discharge may have to be collected and/or filtered to meet environmental guidelines.

4.1.4 Structural Fill Placement and Compaction

Structural fill required throughout the site should consist of the following:

- Approved, imported, quarried rockfill and gravel,
- Approved sand and gravel pit run,
- Approved borrow, or;
- Approved on-site soils.

To prevent adfreeze, backfill directly against the exterior of foundations should consist of a well-graded granular material, containing less than 5% fines (silt/clay). Alternatively, a bond break (such as 2 layers of polyethylene) could be placed directly against the foundations within the frost zone. The backfill material should have a maximum particle size of 80 mm.

Reuse of the on-site soils may be permissible in areas; however, overly wet and/or oversized material will have to be removed.

Structural fill should be placed at or near the optimum moisture content (ASTM D698).

The lift thickness used during placement of structural fill must be compatible with the compaction equipment and the material type to ensure the specified density throughout. For preliminary consideration, the lift thickness should not exceed 300 mm for mass filling and 200 mm for backfilling foundations. The maximum particle size should be no larger than ⅔ of the lift thickness. If the on-site soils are being considered for reuse, special procedures for placement will be required due to soil's clayey nature. We should be contacted if this is the case.

Structural fill should be compacted to the following percentage of maximum standard Proctor dry density (ASTM D698):

Structural fill within building/foundation areas	100%
Structural fill within detention pond	98%
Structural fill within 300 mm of roadway subgrade	98%
Structural fill 300 mm or more below roadway subgrade	95%

Where structural fill is needed below footings, the fill must be extended laterally beyond the edges of the footings to include a 0.3 m bench and the conventional 1H:1V splay.

4.1.5 Roadway Subgrade

The contractor must take precautions to avoid disturbance of the site soils or reinstate the material to the required condition. The condition of the subgrade should be reviewed prior to placement of aggregates.

4.1.6 Slopes

The embankment slopes for the detention pond should not be steeper than 3H:1V for both the inner and outer slopes; however, this should be reviewed once more details are known. The outer slopes of the embankment should be vegetated.

Along the roadway, permanent structural fill slopes should be 2H:1V, or lower. If permanent cut slopes are proposed, we should be contacted.

4.1.7 Winter Construction

Additional effort will be required to conduct earthwork during winter conditions. Winter construction guidelines are attached in Appendix D.

Undertaking earthworks in the winter is not ideal and despite best efforts and good intentions, the quality of earthworks often is compromised.

4.1.8 Observation and Testing

It is recommended that all footing bearing surfaces be observed by an experienced geotechnical engineer prior to placement of concrete. Observation and testing are also recommended during site grading and backfilling operations.

4.2 Foundations

Conventional strip and spread footings and a slab on grade may be considered for the proposed pumping station.

Helical piles were considered for the proposed solar array foundations; however, due to the depth of bedrock in the area and the presence of cobbles and boulders within the till, we would recommend considering the use of spread footings instead.

Recommendations for site preparation are provided in Section 4.1.

4.2.1 Spread/Strip Footings

For strip (continuous) and spread (square) footings founded on undisturbed glacial till or structural fill, the following geotechnical bearing resistances are recommended for design:

- Factored Geotechnical Bearing Resistance (ULS): 250 kPa
- Geotechnical Bearing Resistance (SLS): 150 kPa

The above noted resistances are based on the following assumptions:

- Footings are under level ground and are loaded concentrically
- Strip footings
  - founded a minimum of 1.5 m below grade
  - footing width between 0.6 m and 1.0 m
- Spread footings
  - founded a minimum of 0.6 m below grade
  - footing width between 1.2 m and 2.5 m

Under service loading, total and differential settlement will be less than 25 mm and 20 mm respectively for the service bearing pressure (SLS) mentioned above.

Geotechnical bearing resistances for other footing sizes or conditions can be provided upon request.

For strip (continuous) and spread (square) founded directly on undisturbed bedrock, the following geotechnical bearing resistance is recommended for design:

- Factored Geotechnical Bearing Resistance (ULS): 500 kPa
  - The settlement for footings bearing on bedrock would be negligible (<5 mm).

For foundations on bedrock, the use of lean concrete may be considered to provide a level surface for footing construction.

Exterior footings for a heated structure should be founded a minimum of 1.5 m below grade for frost protection. For an unheated structure, footings should be founded a minimum of 1.8 m below grade. To reduce the amount of cover, the use of insulation could be considered.

4.2.2 Pumping Station Basement

A perimeter foundation drainage and underslab drainage system is recommended for the basement level. The system should include clean-outs. A water-proofing system is recommended for the basement walls.

It is recommended that the abutments be designed based on backfill consisting of a granular wedge within a zone bounded by the wall and a line drawn upwards and outwards at 45 degrees from the base of the wall. Drainage from the backfill zone with a positive outlet is recommended.

For basement wall design, the following parameters can be used:

- Total unit weight of soil, γ_T = 22 kN/m^3 (granular backfill, such as crushed rock aggregate subbase)
- Ultimate friction factor for sliding, μ = 0.6 (cast-in-place concrete to bedrock)
- Ultimate friction factor for sliding, μ = 0.35 (cast-in-place concrete to glacial till)
- Angle of internal friction, Φ = 36 degrees (granular backfill, such as crushed rock aggregate subbase)
- At-rest earth pressure coefficient, K_o = 0.4 (if laterally restrained)

The wall design should include the influence of sloping backfill, surcharge loads behind the wall, and the effects of compaction equipment.

4.2.3 Slab on Grade

A 150 mm thick layer of Granular Class A is recommended below the floor slab for levelling and support purposes. The aggregate should be compacted to 100% Standard Proctor.

A modulus of subgrade reaction, k, of 50 MPa/m may be used for the slab design. This modulus corresponds to a 300 mm x 300 mm square bearing plate.

4.2.4 Seismic Classification

With the foundation areas prepared as discussed in the sections above, the recommended site classification for seismic site response, as per Table 4.1.8.4.B of NBCC 2020 is Site Class C.

4.3 Pavement Structure

For preliminary consideration, the following pavement structures can be considered for the site; however, this should be reviewed once the anticipated traffic loading is known and the subsurface conditions along the south side of site are determined.

Table 4.1: Preliminary Pavement Structure Thicknesses

Material	Light Duty Pavement[1]	Heavy Duty Pavement
Asphalt Concrete: Top Course (Type B) Base Course (Type A)	 40 mm 60 mm	 50 mm 75 mm
Granular Base (Granular Class A)	150 mm	250 mm
Granular Subbase (Select Borrow)	300 mm	300 mm
Geotextile	See Note[2]	See Note[2]

Notes: [1]Cars and light trucks.
[2]A woven geotextile (such as Terratrack 400) is recommended where the subgrade consists of glacial till (ie. has a high percentage of fines).

Prior to placement of aggregates, it will be critical to review the subgrade. Recommendations for site preparation are provided in Section 4.1.

Adequate drainage (subsurface, perforated drain pipe and/or ditching) should be in place to remove water from within the pavement structure. The drainage system should be such that the pavement structure remains adequately drained. Lack of drainage will cause premature deterioration of the asphalt pavement.

All materials should meet the PEIDTIE specifications. The granular base and subbase should be compacted to 100% of Standard Proctor maximum dry density. Asphalt concrete should be compacted as per the PEIDTIE Specifications.

5 Closure

This report has been prepared for the sole benefit of the Client. All information, documentation or other material contained in, attached to, or forming part of this report reflects CBCL's opinion and best judgment based on the information available to us at the time of preparation. Any use or reliance on this report by the Client in circumstances where there has been a change in site conditions or for any purpose not expressly intended by or delineated in this report shall be the sole responsibility of the Client and CBCL accepts no liability for such use or reliance. Any use or reliance on this report by any third party, without CBCL's prior express written consent, shall be the sole responsibility of that third party. CBCL accepts no liability whatsoever for such use or reliance.

The information and conclusions contained in this report are generally consistent with professional standards for engineering and scientific professionals providing similar services at the same time, in similar locations and under similar circumstances.

A geotechnical field investigation is a limited sampling of a site. Some variation between sampling locations should be expected. The conclusions presented in this report represent the technical judgment of CBCL, based on the data obtained from the work and on CBCL's understanding of the project. The data obtained by CBCL is specific to the time the work was performed at the specific testing and/or sampling locations and can only be extrapolated to an undefined limited area surrounding these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the site reflecting natural, construction and other activities. Due to the nature of the investigation and the limited data available, CBCL cannot and does not warrant that undiscovered environmental liabilities and/or undetected subsurface conditions may not arise.

If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we require that we be notified immediately to allow for reassessment of the conclusions provided herein. Further, if there are changes to Client's design, we require that we be notified to allow for review and possible changes to our recommendations.

We trust this is the information you require at this time. We are available to discuss the contents of this report at your convenience.

Prepared by:
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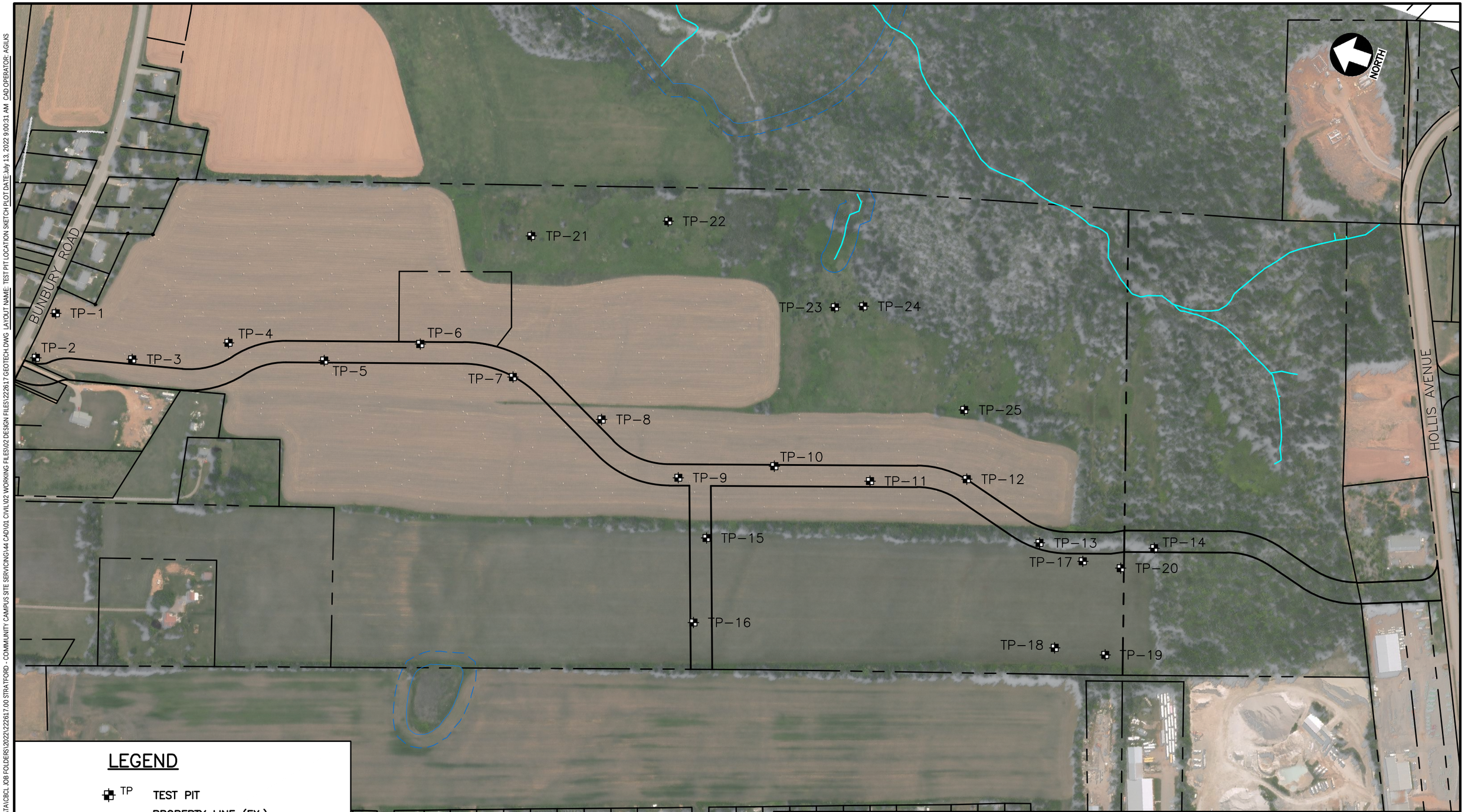
Senior Technical Specialist

APPENDIX A

Test Pit Location Plan – Drawing 01



LEGEND

- TP — TEST PIT
- PROPERTY LINE (EX.)
- PROPERTY LINE (PR.)
- RIGHT OF WAY (PR.)
- PROVINCIAL MAPPED WATERCOURSE (EX.)
- 15m WETLAND BUFFER ZONE
- PROVINCIAL MAPPED WETLAND (EX.)

No.	Description
1	GEOTECHNICAL INVESTIGATION REPORT

Date	Scale	Designed	Drawn	Checked	Approved	CBCL No.	Contract
JULY 2022	1:4000	TSL	AHG	DM	TSL	222617	222617

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STRATFORD COMMUNITY CAMPUS
SITE SERVICING

TEST PIT LOCATION PLAN

Drawing
01

APPENDIX B

Symbols and Terms used on Borehole and Test Pit Records

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SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil	variable mixture of mineral particles and organic matter
Peat	decomposing vegetative matter having fibrous and/or amorphous structure
Till	unstratified glacial deposit which may range from clay to boulders
Fill	any materials below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of regular alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	>75 mm
Seam	2 mm to 75 mm
Parting	< 2 mm
Well Graded	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded	predominantly of one grain size

Terminology describing soils on the basis of grain size and plasticity is based on the ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The classification excludes particles larger than 76 mm (3 inches). This system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	Greater than 20%

The standard terminology to describe cohesionless soils includes the compactness as determined by laboratory test or by the Standard Penetration Test 'N' – value.

Relative Density	'N' Value	Compactness %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

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The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength (Su)		'N' Value
	Kips/sq.ft.	KPa	
Very Soft	< 0.25	< 12.5	< 2
Soft	0.25 – 0.5	12.5 – 25	2 – 4
Firm	0.5 – 1.0	25 – 50	4 – 8
Stiff	1.0 – 2.0	50 – 100	8 – 15
Very Stiff	2.0 – 4.0	100 – 200	15 – 30
Hard	> 4.0	> 200	> 30

ROCK DESCRIPTION

Rock Quality Designation (RQD)

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on N-size (45 mm) core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from in situ fractures.

RQD	ROCK QUALITY
90 – 100	Excellent, intact, very sound
75 – 90	Good, massive, moderately jointed or sound
50 – 75	Fair, blocky and seamy, fractured
25 – 50	Poor, shattered and very seamy or blocky, severely fractured
0 – 25	Very poor, crushed, very severely fractured

Terminology describing rock mass:

Spacing (mm)	Bedding, Laminations, Bands	Discontinuities
2000 – 6000	*Very Thick*	*Very Wide*
600 – 2000	*Thick*	*Wide*
200 – 600	*Medium*	*Moderate*
60 – 200	*Thin*	*Close*
20 – 60	*Very Thin*	*Very Close*
< 20	*Laminated*	*Extremely Close*
< 6	*Thinly Laminated*	

Strength Classification	Uniaxial Compressive Strength (MPa)
Very Weak	1 – 5
Weak	5 – 25
Medium Strong	25 – 50
Strong	50 – 100
Very Strong	100 – 250
Extremely Strong	> 250

Terminology describing weathering:

Slight - Weathering limited to the surface of major discontinuities. Typically iron stained.
Moderate - Weathering extends throughout rock mass. Rock is not friable.
High - Weathering extends throughout rock mass. Rock is friable.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Metamorphic Bedrock | Sedi-mentary

WATER LEVEL MEASUREMENT

Borehole or Standpipe

Piezometer

SAMPLE TYPE AND/OR FIELD TESTS

SS	Split Spoon Sample (obtained by performing the Standard Penetration Test)	AS	Auger Sample
		BS	Bulk Sample
		WS	Wash Sample
ST	Shelby Tube or Thin Wall Tube	HQ, NQ, BQ, etc. Rock Core Samples (obtained with the use of standard size diamond drilling bits)	
PS	Piston sample		
DC	Dynamic Cone Penetration		
FSV	Field Shear Vane		

N- VALUE

Numbers in this column are the results of the SPT (Standard Penetration Test): the number of blows of a 140 pound (64kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and 'N' values cannot be presented, the abbreviation SSR (Split Spoon Refusal) will appear in place of a numerical value.

OTHER TESTS

Symbols in this column indicate that the following laboratory tests have been carried out and the results are presented separately.

S	Sieve analysis	H	Hydrometer analysis
G_s	Specific gravity of soil particles	γ	Unit weight
k	Permeability	C	Consolidation
	Single packer permeability test; test interval from depth shown to bottom of borehole	CD	Consolidated drained triaxial
		CU	Consolidated undrained triaxial with pore pressure measurements
	Double packer permeability test; Test interval as indicated	UU	Unconsolidated undrained triaxial
		DS	Direct shear
	Falling head permeability test using casing	Q_u	Unconfined compression
		I_p	Point Load Index (I_p on Borehole Records equals I_p (50); the index corrected to a reference diameter of 50 mm)
	Falling head permeability test using well point or piezometer	MSV	Laboratory Miniature Shear Vane

APPENDIX C

Test Pit Records

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 687050.0 m, E 394062.5 m

TP - 01

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			28.6				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist			BS	1	
2.0			28.0				
		Very stiff reddish brown sandy lean CLAY with gravel (CL) to compact reddish brown clayey SAND with gravel (SC): TILL - some cobbles below 1.4 m - moist	0.6		BS	2	Moisture Content = 12.8%
5.0							
6.0 / 2.0					BS	3	Moisture Content = 13.9%
8.0							
9.0			25.8				
		End of Test Pit at 2.8 m - INFERRED BEDROCK SURFACE - groundwater not observed	2.8				
10.0 / 3.0							
11.0							
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 687054.9 m, E 394007.3 m

TP - 02

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			29.7				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	29.2		BS	1	
2.0			0.5				
3.0 / 1.0		Loose reddish brown clayey sand with gravel (SC): REWORKED TILL - occasional rootlets - moist			BS	2	Moisture Content = 13.9%
4.0			28.4				
		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - occasional to some cobbles - some boulders (up to 1.5 m in diameter) below 1.6 m - moist	1.3		BS	3	Moisture Content = 14.4%
5.0							
6.0 / 2.0							
7.0					BS	4	Moisture Content = 15.8%
8.0							
9.0			26.8				
		End of Test Pit at 2.9 m - INFERRED BEDROCK SURFACE - groundwater not observed	2.9				
10.0 / 3.0							
11.0							
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686950.9 m, E 394041.3 m

TP - 03

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			31.2				
		ROOTMAT - 150 mm thick	0.0				
		Loose brown silty sand (SM) to silty sand with gravel (SM): REWORKED TILL - moist			BS	1	
1.0					BS	2	Moisture Content = 11.8%
2.0		Loose reddish brown silty sand with gravel (SM): REWORKED TILL - occasional cobbles - moist					
3.0 / 1.0					BS	3	
4.0			29.9				
		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - occasional to some cobbles - moist	1.3				
5.0							
6.0							
7.0 / 2.0							
8.0					BS	4	Moisture Content = 16.8%
9.0							
10.0 / 3.0							
11.0			27.8				
		End of Test Pit at 3.4 m - INFERRED BEDROCK SURFACE - groundwater not observed	3.4				
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686853.4 m, E 394094.7 m

TP - 04

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			29.7				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose silty sand with gravel (SM): REWORKED TILL - occasioanl rootlets - moist	29.2		BS	1	
2.0		Loose reddish brown clayey gravel with sand (GC): REWORKED TILL - some cobbles - moist	0.5		BS	2	Moisture Content = 13.1%
3.0 / 1.0							
4.0							
5.0			28.1				
		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - some cobbles and boulders (up to 0.9 m in diameter) - moist	1.6		BS	3	Moisture Content = 14.6%
6.0							
7.0 / 2.0							
8.0							
			27.0				
9.0		End of Test Pit at 2.7 m - INFERRED BEDROCK SURFACE - groundwater not observed	2.7				
10.0 / 3.0							
11.0							
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686744.1 m, E 394111.0 m

TP - 05

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			26.5				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	26.0		BS	1	
			0.5				
2.0		Loose reddish brown clayey sand with gravel (SC): REWORKED TILL - occasional cobbles - moist			BS	2	
3.0 / 1.0			25.5				
			1.0				
4.0		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - some cobbles - occasional boulders (up to 0.9 m in diameter) below 2.0 m - moist			BS	3	Moisture Content = 15.2%
6.0 / 2.0							
8.0					BS	4	Moisture Content = 16.5%
10.0 / 3.0							
11.0			23.1				
		End of Test Pit at 3.4 m - INFERRED BEDROCK SURFACE - groundwater not observed	3.4				
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686646.9 m, E 394164.3 m

TP - 06

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			21.7				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - moist	21.4 0.3		BS	1	
2.0		Loose reddish brown clayey sand with gravel (SC): REWORKED TILL - occasional cobbles - moist			BS	2	Moisture Content = 12.8%
3.0 / 1.0			20.7 1.0				
4.0		Very stiff reddish brown sandy lean CLAY with gravel (CL) to compact reddish brown clayey SAND with gravel (SC): TILL - occasional to some cobbles - occasional boulders (up to 0.9 m in diameter) below 2.0 m - moist			BS	3	Moisture Content = 14.8%
5.0							
6.0 / 2.0							
7.0							
8.0					BS	4	Moisture Content = 16.5%
9.0							
10.0 / 3.0			18.5				
		INFERRED SANDSTONE BEDROCK	3.2				
11.0		End of Test Pit at 3.3 m - groundwater not observed					
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686535.2 m, E 394163.1 m

TP - 07

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			19.2				
		ROOTMAT - 150 mm thick	0.0		BS	1	
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - moist	18.9 0.3				
2.0		Loose reddish brown clayey sand with gravel (SC): REWORKED TILL - moist	18.4 0.8		BS	2	
3.0 / 1.0		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - occasional to some cobbles - moist to wet (at depth)			BS	3	Moisture Content = 14.4%`
4.0							
5.0							
6.0							
7.0 / 2.0					BS	4	Moisture Content = 15.6%
8.0							
9.0			16.5 2.7				
10.0 / 3.0		End of Test Pit at 2.7 m - INFERRED BEDROCK SURFACE - groundwater not observed					
11.0							
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686424.2 m, E 394150.2 m

TP - 08

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 26, 2022

Water Level: N/A

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			20.5				
		ROOTMAT - 150 mm thick	0.0		BS	1	
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	20.2 0.3		BS	2	Moisture Content = 14.8%
2.0		Firm reddish brown sandy lean clay (CL): REWORKED TILL - occasional gravel - moist	19.8 0.7		BS	3	Moisture Content = 14.1%
1.0 / 3.0		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - occasional to some cobbles - some boulders (up to 1.0 m in diameter) below 2.3 m - moist			BS	4	Moisture Content = 14.1%
2.0 / 4.0							
5.0							
6.0							
7.0							
8.0							
9.0							
3.0 / 10.0					BS	5	
11.0							
12.0			16.9				
		End of Test Pit at 3.6 m - INFERRED BEDROCK SURFACE - groundwater not observed	3.6				
4.0 / 13.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

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Project Name: Community Campus Site Servicing
Location: N 686320.2 m, E 394116.0 m
Project No.: 222617.00
Client: Town of Stratford
Water Level: N/A

TP - 09
Sheet: 1 of 1
Date: May 26, 2022
Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			23.7				
		ROOTMAT - 150 mm thick	0.0				
		Loose brown silty sand (SM): REWORKED TILL - occasional rootlets and gravel - moist	23.4 0.3		BS	1	
2.0		Firm reddish brown sandy lean clay with gravel (CL) to loose reddish brown clayey sand with gravel (SC): REWORKED TILL - occasional cobbles - moist			BS	2	Moisture Content = 14.0%
3.0 / 1.0			22.7 1.0				
4.0		Very stiff reddish brown sandy lean CLAY (CL): TILL - occasional to some gravel and cobbles - moist					
5.0					BS	3	Moisture Content = 16.0%
6.0 / 2.0			21.6				
7.0		INFERRED SANDSTONE BEDROCK	2.1				
9.0					BS	4	
10.0 / 3.0							
11.0			20.1				
12.0		End of Test Pit at 3.6 m - groundwater not observed	3.6				
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Conquest Engineering
Experience commitment.
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Project Name: Community Campus Site Servicing
Location: N 686221.2 m, E 394163.9 m
Project No.: 222617.00
Client: Town of Stratford
Water Level: N/A

TP - 10
Sheet: 1 of 1
Date: May 25, 2022
Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			20.0				
		ROOTMAT - 200 mm thick	0.0 19.8				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	0.2		BS	1	
2.0			19.2				
3.0 / 1.0		Very stiff reddish brown sandy lean CLAY (CL) to sandy lean CLAY with gravel (CL): TILL - some cobbles below 1.6 m - moist	0.8		BS	2	Moisture Content = 13.2%
4.0							
5.0					BS	3	Moisture Content = 15.2%
6.0			18.0				
7.0 / 2.0		INFERRED SANDSTONE BEDROCK	2.0				
8.0							
9.0							
10.0 / 3.0					BS	4	
11.0							
12.0							
13.0 / 4.0			16.1				
		End of Test Pit at 3.9 m - groundwater not observed	3.9				
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686113.0 m, E 394183.3 m

TP - 11

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: N/A

Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			19.2				
		ROOTMAT - 200 mm thick	0.0 19.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	0.2		BS	1	Moisture Content = 18.2%
2.0			18.4				
3.0 / 1.0		Very stiff reddish brown sandy lean CLAY (CL): TILL - some gravel - some cobbles below 1.7 m - moist	0.8		BS	2	Moisture Content = 17.4%
4.0							
5.0							
6.0 / 2.0							
7.0							
8.0							
9.0					BS	3	Moisture Content = 17.1%
10.0 / 3.0							
11.0							
12.0							
13.0 / 4.0			15.2				
		End of Test Pit at 4.0 m - INFERRED BEDROCK SURFACE - groundwater not observed	4.0				
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686009.7 m, E 394221.2 m

TP - 12

Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: N/A

Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			17.3				
		ROOTMAT - 150 mm thick	0.0				
		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	17.0 0.3		BS	1	
1.0 / 2.0 / 3.0 / 1.0		Very stiff reddish brown sandy lean CLAY (CL) to sandy lean CLAY with gravel (CL): TILL - occasional to some cobbles - some boulders (up to 0.6 m in diameter) below 2.0 m - moist			BS	2	Moisture Content = 16.2%
4.0 / 5.0 / 6.0 / 2.0 / 7.0 / 8.0 / 9.0 / 3.0 / 10.0					BS	3	Moisture Content = 16.2%
11.0 / 12.0 / 13.0 / 4.0			13.1				
14.0 / 15.0 / 16.0		End of Test Pit at 4.2 m - INFERRED BEDROCK SURFACE - groundwater not observed	4.2				

TEST PIT RECORD

Project Name: Community Campus Site Servicing
Location: N 685907.9 m, E 394179.6 m
Project No.: 222617.00
Client: Town of Stratford
Water Level: N/A

TP - 13
Sheet: 1 of 1
Date: May 25, 2022
Datum: Geodetic

Conquest Engineering
Experience commitment.
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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			21.7				
		ROOTMAT - 200 mm thick	0.0 21.5				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	0.2 21.0		BS	1	
2.0		Very stiff reddish brown sandy lean CLAY (CL): TILL - occasional to some gravel and cobbles - moist to wet (at depth)	0.7		BS	2	Moisture Content = 14.1%
3.0 / 1.0							
4.0							
5.0							
6.0							
7.0 / 2.0							
8.0							
9.0					BS	3	Moisture Content = 21.7%
10.0 / 3.0							
11.0							
			18.1				
12.0		End of Test Pit at 3.6 m - INFERRED BEDROCK SURFACE - groundwater not observed	3.6				
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 685782.8 m, E 394216.4 m

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Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: 2.6 m

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			21.7				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist			BS	1	
2.0							
3.0 / 1.0			20.8				
		Firm reddish brown sandy lean clay (CL): REWORKED TILL - occasional gravel - moist	0.9		BS	2	Moisture Content = 16.5%
4.0							
5.0			20.1				
		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - occasional cobbles - moist to wet	1.6				
6.0							
7.0 / 2.0							
8.0				▼	BS	3	Moisture Content = 15.2%
9.0							
10.0 / 3.0			18.4				
11.0		INFERRED SANDSTONE BEDROCK	3.3		BS	4	
			18.2				
		End of Test Pit at 3.5 m - slight groundwater seepage observed at 2.6 m	3.5				
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Conquest Engineering
Experience commitment.
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Project Name: Community Campus Site Servicing
Location: N 686267.6 m, E 394061.7 m
Project No.: 222617.00
Client: Town of Stratford
Water Level: N/A

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Sheet: 1 of 1
Date: May 25, 2022
Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			26.9				
		ROOTMAT - 200 mm thick	0.0 26.7				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	0.2 26.2		BS	1	
2.0		Loose reddish brown clayey sand (SC): REWORKED TILL - occasional gravel - moist	0.7 26.0		BS	2	Moisture Content = 14.3%
3.0 / 1.0			0.9				
4.0		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - some cobbles and boulders (up to 1.0 m in diameter) below 1.6 m - moist			BS	3	Moisture Content = 16.5%
5.0							
6.0							
7.0 / 2.0							
8.0							
9.0					BS	4	Moisture Content = 16.3%
10.0 / 3.0							
11.0							
12.0			23.2				
		End of Test Pit at 3.7 m - INFERRED BEDROCK SURFACE - groundwater not observed	3.7				
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686250.4 m, E 393966.0 m

Project No.: 222617.00

Client: Town of Stratford

Water Level: N/A

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Sheet: 1 of 1

Date: May 26, 2022

Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			32.0				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist			BS	1	
2.0			31.3				
		Very stiff reddish brown sandy lean CLAY (CL): TILL - occasional to some gravel - some cobbles below 1.3 m - moist	0.7		BS	2	Moisture Content = 16.7%
1.0							
2.0					BS	3	Moisture Content = 15.1%
			29.7				
		INFERRED SANDSTONE BEDROCK	2.3				
3.0					BS	4	
			28.4				
		End of Test Pit at 3.6 m - groundwater not observed	3.6				
4.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 685854.6 m, E 394175.8 m

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Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: N/A

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			22.9 / 0.0				
		ROOTMAT - 200 mm thick	22.7 / 0.2				
1.0		Loose brown silty, clayey sand (SM): REWORKED TILL - occasional rootlets - occasional to some gravel - moist			BS	1	Moisture Content = 17.1%
2.0			22.3 / 0.6				
3.0 / 1.0		Firm to stiff reddish brown sandy lean clay with gravel (CL) to loose to compact reddish brown clayey sand with gravel (SC): REWORKED TILL - moist			BS	2	Moisture Content = 13.1%
4.0			21.5 / 1.4				
5.0		Very stiff reddish brown sandy lean CLAY (CL): TILL - occasional to some gravel and cobbles - moist					
6.0							
7.0 / 2.0							
8.0							
9.0					BS	3	Moisture Content = 15.9%
10.0 / 3.0							
11.0							
12.0			19.0 / 3.9				
13.0 / 4.0		End of Test Pit at 3.9 m - INFERRED BEDROCK SURFACE - groundwater not observed					
14.0							
15.0							
16.0							

TEST PIT RECORD

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Project Name: Community Campus Site Servicing
Location: N 685852.8 m, E 394072.4 m
Project No.: 222617.00
Client: Town of Stratford
Water Level: N/A

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Sheet: 1 of 1
Date: May 25, 2022
Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			28.4				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown clayey sand with gravel (SC): REWORKED TILL - occasional rootlets - moist			BS	1	
2.0			27.7				
		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - occasional to some gravel and cobbles - moist	0.7				
3.0 / 1.0							
4.0							
5.0					BS	2	Moisture Content = 15.5%
6.0							
7.0 / 2.0			26.1				
		INFERRED SANDSTONE BEDROCK	2.3				
8.0							
9.0							
10.0 / 3.0							
11.0					BS	3	
12.0							
13.0 / 4.0							
14.0							
			23.9				
15.0		End of Test Pit at 4.5 m - groundwater not observed	4.5				
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 685795.9 m, E 394083.5 m

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Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: N/A

Datum: Geodetic

Conquest Engineering
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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			28.4				
		ROOTMAT - 150 mm thick	0.0				
1.0		Loose brown clayey sand (SC): REWORKED TILL - occasional rootlets and gravel - moist			BS	1	Moisture Content = 18.2%
2.0							
3.0 / 1.0			27.5				
		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - some cobbles - some boulders (up to 0.6 m in diameter) below 1.5 m - moist	0.9		BS	2	Moisture Content = 14.1%
4.0							
5.0							
6.0							
7.0 / 2.0					BS	3	Moisture Content = 16.5%
8.0							
9.0			25.5				
		INFERRED SANDSTONE BEDROCK	2.9				
10.0 / 3.0		End of Test Pit at 3.0 m - groundwater not observed					
11.0							
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing
Location: N 685811.4 m, E 394182.5 m
Project No.: 222617.00
Client: Town of Stratford
Water Level: N/A

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Sheet: 1 of 1
Date: May 25, 2022
Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			23.1				
		ROOTMAT - 200 mm thick	0.0 22.9				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets - moist	0.2		BS	1	
2.0			22.2				
3.0 / 1.0		Firm sandy lean clay with gravel (CL): REWORKED TILL - moist	0.9		BS	2	Moisture Content = 12.4%
4.0			21.6				
5.0		Very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - some cobbles and boulders (up to 0.9 m in diameter) below 2.4 m - moist	1.5		BS	3	Moisture Content = 16.1%
6.0 / 2.0							
7.0							
8.0							
9.0					BS	4	Moisture Content = 16.7%
10.0 / 3.0							
11.0							
12.0							
13.0 / 4.0			19.1				
		End of Test Pit at 4.0 m - INFERRED BEDROCK SURFACE - groundwater not observed	4.0				
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686567.7 m, E 394321.6 m

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Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: 4.3 m

Datum: Geodetic

Conquest Engineering
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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0		ROOTMAT - 120 mm thick	12.1 0.0				
1.0		Loose brown clayey sand with gravel (SC): REWORKED TILL - occasional rootlets - moist	11.7 0.4		BS	1	
2.0		Very stiff reddish brown sandy lean CLAY with gravel (CL) to compact reddish brown clayey SAND with gravel (SC): TILL - occasional to some cobbles - moist					
3.0 / 1.0							
4.0							
5.0					BS	2	Moisture Content = 16.2%
6.0							
7.0 / 2.0							
8.0							
9.0							
10.0 / 3.0							
11.0					BS	3	Moisture Content = 15.2%
12.0							
13.0 / 4.0							
14.0			7.8 4.3	▼			
15.0		End of Test Pit at 4.3 m - INFERRED BEDROCK SURFACE - slight groundwater seepage observed at 4.3 m					
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686426.0 m, E 394388.1 m

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Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: 3.3 m

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			9.5				
		ROOTMAT - 300 mm thick	0.0				
1.0			9.2				
		Loose brown clayey sand (SC): REWORKED TILL - occasional roots - moist	0.3 9.0		BS	1	
2.0			0.5				
3.0 / 1.0		Compact reddish brown clayey SAND with gravel (SC): TILL - some cobbles and boulders (up to 1.2 m in diameter) - moist to wet (below 1.8 m)			BS	2	Moisture Content = 13.8%
4.0							
5.0							
6.0 / 2.0							
7.0							
8.0					BS	3	Moisture Content = 15.7%
9.0							
10.0 / 3.0			6.2	▼			
11.0		End of Test Pit at 3.3 m - INFERRED BEDROCK SURFACE - slight groundwater seepage observed at 3.3 m	3.3				
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686215.1 m, E 394357.2 m

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Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: 3.2 m

Datum: Geodetic

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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			8.4				
		ROOTMAT - 200 mm thick	0.0				
			8.2				
1.0		Loose brown clayey sand (SC): REWORKED TILL - occasional rootlets - moist	0.2		BS	1	Moisture Content = 18.0%
2.0		Compact reddish brown clayey SAND with gravel (SC) to very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - occasional to some cobbles - some boulders (up to 0.7 m in diameter) below 1.9 m - moist to wet (at depth)					
1.0 / 3.0					BS	2	Moisture Content = 16.1%
4.0							
5.0							
6.0							
2.0 / 7.0							
8.0							
9.0					BS	3	Moisture Content = 14.7%
3.0 / 10.0				▼			
11.0			5.0				
		End of Test Pit at 3.4 m - INFERRED BEDROCK SURFACE - moderate groundwater seepage observed at 3.2 m	3.4				
12.0							
13.0 / 4.0							
14.0							
15.0							
16.0							

TEST PIT RECORD

Project Name: Community Campus Site Servicing

Location: N 686184.9 m, E 394368.8 m

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Project No.: 222617.00

Sheet: 1 of 1

Client: Town of Stratford

Date: May 25, 2022

Water Level: 3.3 m

Datum: Geodetic

Conquest Engineering
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SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			8.7				
		ROOTMAT / TOPSOIL - 400 mm thick	0.0		BS	1	
1.0			8.3				
		Compact reddish brown clayey SAND with gravel (SC) to very stiff reddish brown sandy lean CLAY with gravel (CL): TILL - some cobbles and boulders (up to 0.8 m in diameter) below 2.0 m - moist to wet (at depth)	0.4		BS	2	Moisture Content = 14.9%
1.0 / 2.0							
2.0 / 3.0					BS	3	Moisture Content = 15.7%
3.0 / 4.0				▼			
			4.9				
		End of Test Pit at 3.8 m - bedrock not encountered - slight to moderate groundwater seepage observed at 3.3 m	3.8				

TEST PIT RECORD

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Project Name: Community Campus Site Servicing
Location: N 686038.1 m, E 394294.7 m
Project No.: 222617.00
Client: Town of Stratford
Water Level: N/A

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Sheet: 1 of 1
Date: May 25, 2022
Datum: Geodetic

SUBSURFACE PROFILE					SAMPLE		
Depth (ft / m)	Symbol	Soil and/or Rock Description	Elevation / Depth (m)	Water Level (m)	Type	Number	Comments
0.0 / 0.0			13.3				
		ROOTMAT - 300 mm thick	0.0 13.0				
1.0		Loose brown silty sand with gravel (SM): REWORKED TILL - occasional rootlets and gravel - moist	0.3 12.5		BS	1	Moisture Content = 25.2%
2.0		Very stiff reddish brown sandy lean CLAY with gravel (CL) to compact reddish brown clayey SAND with gravel (SC): TILL - occasional to some cobbles - some boulders (up to 0.6 m in diameter) below 2.5 m - moist	0.8				
3.0 / 1.0							
4.0					BS	2	Moisture Content = 14.5%
5.0							
6.0 / 2.0							
7.0							
8.0							
9.0							
10.0 / 3.0							
11.0					BS	3	Moisture Content = 14.7%
12.0							
13.0 / 4.0							
14.0							
15.0			8.6				
		End of Test Pit at 4.7 m - INFERRED BEDROCK SURFACE - groundwater not observed	4.7				
16.0							

APPENDIX D

Geotechnical Guidelines for Winter Construction

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Geotechnical and Materials Engineers

GEOTECHNICAL RECOMMENDATIONS
WINTER CONSTRUCTION

The following are general geotechnical recommendations for earthworks for building areas in winter conditions.

General

- Earthworks conducted during freezing conditions are suspect. Special procedures and precautions must be exercised to minimize the risk of future problems.

- A site meeting should be held at project start-up to discuss the schedules of the various contractors in relation to the following geotechnical recommendations.

Excavation

- The rootmat/topsoil layer and any overlying snow will reduce the frost penetration. Conducting only the excavation work required for each day of work is recommended to minimize freezing of the soil in the foundation areas.

- Excavated material to be used as structural fill should not be stockpiled, but should be placed and compacted immediately after excavation.

Fill Placement

Based on our experience, it is generally impractical to place well-graded gravel, sand, or fine-grained soils in temperatures lower than about -5 degrees Celsius. On very cold days, loose material starts to freeze within about 15 minutes. At temperatures below -5 degrees Celsius, clear gravel or clear rockfill is recommended but subject to design considerations governing the work.

The following provides recommendations for all structural fill types.

- Structural fill placement should be conducted in small areas. Depending on the temperature, this may allow for continuous placement of fill lifts during the work day without the requirement for excavation of frozen material prior to placement of the next lift.

    - Material containing snow or ice should not be incorporated in the work. During snow events, fill placement should be stopped. When the earthwork restart, all snow and ice should be removed from the fill surface prior to subsequent fill placement. In order to remove all snow and/or ice after a snow event, some of the underlying fill may have to be removed and wasted.

- For intermediate fill lifts, frost protection (e.g.; straw, insulated tarp, etc) should be provided at the end of the work day, or alternatively, fill that freezes overnight should be removed in the morning. Also, any snow or ice should also be removed. Fill surfaces should be sloped to prevent ponding of water during milder weather.

- The final fill surface, the base of footing excavations and slab subgrade should be protected from freezing. If the final fill surface is exposed to freezing temperatures, heat will be required to thaw the soil. Test pits and temperature readings could be completed to determine if the soil is above freezing. Consideration should also be given to the installation of thermocouples in the fill during placement, as a means of reading temperatures at depth. The areas that were frozen should be proof-rolled.

  - The moisture content of fill materials should be approximately 2% below optimum. Fill materials with moisture contents above the optimum should not be used.

- Loose edges of the structural fill lifts should be avoided to reduce frost penetration. Edges of fill lifts should be tapered and compacted.

- Regular checks of the temperature of the fill should be made. The soil temperature should be greater than +2°C to allow for compaction to the specified degree.

Footing Construction

- Footings should not be placed on frozen material.

- Where the footing elevation is within approved finer-grained materials, we recommend over-excavation by at least 6 inches and placement of nominal 1 inch stone or other clean gravel. This will reduce disturbance of the bearing surface.

- Following construction of footings, temporary frost protection must be provided to avoid freezing of the bearing surface and for protection of the concrete during curing.

- Consideration should be given to specifying that the footing depth for interior foundations be 1.2 m below slab subgrade for frost protection during construction; or alternatively, fill could be temporary bermed over interior footings to provide insulation.

- Foundations should be backfilled with a free-draining granular material and drainage provided to prevent adfreeze of foundations, particularly during construction.

- Cast-in-place concrete should be protected during colder weather conditions as per CSA A23.1-2009.

Geotechnical Inspection and Testing

The information herein should be reviewed by geotechnical personnel and customized to the specific geotechnical aspects and design considerations of a site. Full-time inspection and testing by experience geotechnical personnel is particularly important during earthworks in winter conditions and is strongly recommended.

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