SQUAMISH-LILLOOET REGIONAL DISTRICT

BRALORNE SANITARY SEWER RECONSTRUCTION

CONTRACT DOCUMENTS AND SPECIFICATIONS

SET NO. _____

TRUE **Consulting**
Date: April 2018
Project No. 649-015

PLANHOLDER REGISTRATION FORM

Request for Tender No. 649-015

SQUAMISH-LILLOOET REGIONAL DISTRICT

BRALORNE SANITARY SEWER RECONSTRUCTION

CLOSING DATE AND TIME: TUESDAY, MAY 1st, 2018 @ 2:00PM

For any further distributed information about this Request for Tender please complete this form and e-mail or fax to:

TRUE CONSULTING
201-2079 FALCON ROAD
KAMLOOPS, BC V2C 4J2
Attention: **Stu Purves, P. Eng.**
Fax: 250-828-0717
Email: info@true.bc.ca

Company Name:			
Address:			
Contact Person:			
Contact Telephone:		Contact Fax:	
Contact Email:			

Only Proponents completing this form will be issued any addendums and/or any additional information regarding this tender. It is the sole responsibility to the Proponent to ensure that the receipt confirmation form has been received by TRUE Consulting.

_____ _____

Signature Date

SQUAMISH LILLOET REGIONAL DISTRICT
BRALORNE SANITARY SEWER RECONSTRUCTION

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STANDARD DRAWINGS (bound into design drawings)

INVITATION TO TENDER

SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SANITARY SEWER UPGRADES

Sealed Tenders clearly marked **"Bralorne Sanitary Sewer Upgrades"** will be received at the Squamish-Lillooet Regional District office, 1350 Aster Street, Pemberton B.C. V0N 2L0 up to 2:00 p.m. local time, Tuesday, May 1st, 2018. Tenders will not be open in public.

The project comprises the following works and approximate quantities:

- 2000m of 200mm PVC sanitary sewer main at 1-3m depth
- 280m of 200mm PVC sanitary sewer mains over 3m depth
- 185m of 150mm PVC sanitary sewer mains at 1-3m depth
- 107-100mm sanitary sewer services and appurtenances including connections to existing sewer system
- 45 sanitary sewer manholes
- Sanitary sewer treatment system including septic tank installation, biofilter installation, and outfall

Tender Documents are available electronically on the Squamish-Lillooet Regional District website and/or BC Bid. Printed copies are available from the offices of TRUE Consulting (Kamloops) at a cost of $100, which is non-refundable. A Planholder Registration Form must be completed and emailed to TRUE Consulting at info@true.bc.ca in order to receive any addendums and/or additional information regarding this tender. It is the sole responsibility of the Planholder to ensure that the Registration Form has been received by TRUE Consulting.

Tenders must be accompanied by the following:

(1) A CONSENT OF SURETY relating to subsequent security arrangements for PERFORMANCE and LABOUR AND MATERIALS PAYMENT GUARANTEES.

If the information stipulated above is not enclosed with the Tender at the time of opening, the Tender will be rejected.

Tenders received after the closing time will be returned unopened.
The lowest or any Tender will not necessarily be accepted. Note that the term Tender and Bid will be uses interchangeably throughout this document.

Engineer

TRUE Consulting
Site. 201 - 2079 Falcon Road
Kamloops, B.C. V2C 4J2

Phone: (250) 828-0881
Fax: (250) 828-0717

Owner

Squamish-Lillooet Regional District
1350 Aster Street
Pemberton, B.C. V0N 2L0

Phone: (604) 894-6371
Fax: (604) 894-6526

INSTRUCTIONS TO TENDERERS

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INSTRUCTIONS TO TENDERERS

2.1 SUBMISSION OF TENDER

Sealed Tenders shall be addressed to:

Squamish-Lillooet Regional District
1350 Aster Street,
Pemberton, B.C. V0N 2L0

Attention: Jeff Giffin, Director of Utilities and Environmental Services

The Tender envelope shall be clearly marked **"Bralorne Sanitary Sewer Reconstruction"**.

It is the Tenderer's responsibility to ensure that the Tender is in the hands of the Owner no later than Tuesday, May 1st, 2018 at 2:00 p.m.

2.2 ACCEPTANCE OR REJECTION OF TENDERS

The Owner reserves the right to reject any or all Tenders and to waive irregularities and formalities at his discretion. The lowest, or any, Tender will not necessarily be accepted. The Owner reserves the right to reduce scope or remove portions of the project based on the available funds.

In reviewing tenders and awarding the Contract for this project, the Owner may consider not only the tendered prices but the overall value that the tender represents to the Owner based on quality, service and price, and the tenderer's experience and qualifications considered essential by the Owner for the satisfactory completion of this type and size of project, including but not limited to:

a) Previous completed projects of this type and/or size
b) Similar projects currently being undertaken by the tenderer
c) Key office and site personnel to be assigned by the tenderer to this project
d) Time for completion of the Work
e) Additional value added services

Without limiting the generality of the foregoing, any tender may be rejected for any of the following reasons:

- Incomplete Tender;
- Obscured or irregular erasures or corrections in the Tender Form;
- Prices omitted or unbalanced;
- Evidence of inadequate capacity to perform the contract;
- Evidence of previous failure to perform adequately on similar work.

The Owner may accept a Tender by issuing a "Notice of Acceptance".

2.3 INFORMATION CONCERNING TENDERS

Tenderers shall carefully examine the Contract Documents and the site of the Proposed Work, and shall fully inform themselves as to all existing conditions and limitations which will affect the execution of the Contract. No consideration will be given after submission of a Tender to any claim that there was any misunderstanding with respect to the conditions imposed by the Contract.

Discussions or other oral conversations shall not become a part of the Contract Documents or shall not modify the Contract Documents unless confirmed by Addenda.

2.4 ADDENDA

If there are to be any changes in the Work, or in the tendering procedures, the Tenderers will be informed, prior to the close of the period allowed for received Tenders, by means of an Addendum, a written communication issued by the Owner. All Addenda shall become a part of the Contract Documents, and receipt of Addenda must be acknowledged by the Tenderer in the Tender.

2.5 DISCREPANCIES AND OMISSIONS

If a Tenderer finds discrepancies in, or omissions from the drawings, specifications, or other documents or has any doubt as to the meaning or intent of any part thereof, he shall at once inform the Owner in writing. Any necessary changes, or additions, or further explanations will be made by the Owner by issuing an Addendum.

2.6 COMPLETION DATE

Construction shall be completed by December 31st, 2018.

2.7 PREVIOUS EXPERIENCE

The Tenderer shall complete a statement of previous and existing clients for whom similar contract work has been undertaken. This statement of previous experience shall be completed on the form provided and submitted with the Tender.

2.8 PERFORMANCE SECURITY

The Tenderer to whom the Contract Award is made shall furnish the Squamish-Lillooet Regional District, within seven (7) calendar days after receipt of Notice of Award, either of the following:

1. A Performance Bond to the Squamish-Lillooet Regional District in the amount of fifty percent (50%) of the Total Contract Sum, and a Labour and Materials Payment Bond in the amount of fifty percent (50%) of the Total Contract Sum and be in a format consistent with "SAC Performance Bond 2012" as prepared by the Surety Association of Canada. The Performance Bond shall include and cover the Contractor's obligations during the Maintenance Period, or

2. An Irrevocable Letter of Credit to the Squamish-Lillooet Regional District executed on the form provided for in these Contract Documents, in the amount of one hundred percent (100%) of the Total Contract Sum for the Performance and Labour and Materials Payment Guaranty and an Irrevocable Letter of Credit in the amount of ten percent (10%) of the Total Contract Sum for a Maintenance Guaranty.

Only those Performance, Labour and Materials Payment, Bonds and Letters of Credit that are acceptable to the Owner will be considered.

Where a Tenderer elects to use a CLEAN IRREVOCABLE LETTER OF CREDIT for a Performance Security (as outlined in (2) of this section), the certified cheque or bank draft submitted as tender security will be returned to the successful tenderer after the clean irrevocable Letter of Credit has been deposited with the Owner as the performance security.

2.9 MAINTENANCE SECURITY

Upon contract completion and where a performance bond including maintenance provisions is not provided, the successful Tenderer shall provide maintenance security, in the amount of ten percent (10%) of the Final Contract Sum, in the form of a CERTIFIED CHEQUE, BANK DRAFT or CLEAN IRREVOCABLE LETTER OF CREDIT, payable to the Squamish-Lillooet Regional District.

The Maintenance Security shall be valid, and in force, for a period of one (1) year from the Date of Completion of the Contract.
The Maintenance Security shall be deposited with the Owner PRIOR to release of the Performance Security.

2.10 INSURANCE COVERAGE

The Tenderer shall provide, within seven (7) days after execution of the Contract Agreement by the Owner, Certificates of Insurance to cover public liability and property damage and automobiles owned and non-owned, as outlined in the General Conditions.

2.11 INFORMATION AND SITE VISIT ARRANGEMENTS

Tenderers may examine the project site during regular working hours.

2.12 SUBCONTRACTORS AND EQUIPMENT

The Tenderer must show in the Tender Form the names and business addresses of proposed subcontractors and the equipment intended to be used, including capacities of each machine. The words "as required" or similar wording are not a sufficient description.

2.13 CANCELLATION OF TENDER

The Owner reserves the right to withdraw from the Tender process, at any time, even after the close of Tenders. The Owner shall not be responsible for any costs incurred by any Tenderer for the preparation of a Tender for this Contract in the event that the Tender Call is cancelled and/or all Tenders are rejected.

2.14 AMENDMENT OF TENDERS

The tenderer may amend or revoke a tender by giving written notice delivered by hand, mail or fax to the office referred to in paragraph 2.1 of the Instructions to Tenders, providing the following conditions are met:

- An amendment or revocation must be received by the *Tender Closing Date and Time.* An amendment or revocation that is received after the *Tender Closing Date and Time* shall not be considered and shall not affect a tender as submitted.
- An amendment or revocation must be signed by an authorized signatory of the Tenderer, with the date and project title clearly stated.
- Amendment must clearly state which tender prices or items are being deleted, and which revised prices or items are being submitted.
- Any amendment that expressly or by inference discloses the Tenderer's Tender Price (Contract Sum) or other material element of the tender such that, in the opinion of the Owner, the confidentiality of the tender is breached, will invalidate that Tenderer's entire tender.

The Owner assumes no risk or responsibility whatsoever that any fax will be received as required, and shall not be liable to any Tenderer if for any reason a fax is not properly received.

Should the above conditions not be met, the amendment will be disregarded and the Tender evaluated as received.

2.15 TENDER SUBMISSION – DISCREPANCIES AND OMISSIONS

At the tender close, the owner or his representative will witness receipt of tender submissions. The tenders will be checked for general conformance with submission requirements only (i.e. provision of securities, completed tender form).

Subsequent to the tender close, an audit will be conducted by the owner or his representative to check individual tenders for completeness and accuracy. Errors and omissions will be dealt with as follows:

- Omission of prices, obscured or irregular erasures, or corrections of prices in the tender form (or faxed revisions) which lead to the inability to determine a fixed contract sum will result in the rejection of the tender. Omission of both a unit price and corresponding extended total for a tender item will be cause for rejection of the tender.
- If there are any discrepancies in the *Schedule of Quantities and Prices* between the unit prices and the extended totals, then the unit prices shall be deemed to be correct and corresponding corrections will be made to the extended totals.
- If a unit price or extended total has been omitted, the following shall apply:
    - If a unit price is given but the corresponding extended total has been omitted, then the extended total shall be calculated from the unit price and the estimated quantity, and inserted as the extended total.
    - If an extended total is given but the corresponding unit price has been omitted, then the unit price shall be calculated from the extended total and the estimate quantity, and inserted as the unit price.

TENDER OF:

_____

_____

_____

(hereinafter called "the Tenderer")

TO: Squamish-Lillooet Regional District
1350 Aster Street,
Pemberton, B.C. V0N 2L0

To Whom it May Concern:

In response to the Invitation to Tender, the Tender and Contract Documents, and the site of the proposed Work have been carefully examined for the

Bralorne Sanitary Sewer Reconstruction

located

in Bralorne, B.C.

The Undersigned offers to provide all necessary labour, equipment, materials and tools to undertake the Work in accordance with these Contract Documents and Drawings for prices quoted in this Tender Form. The Tenderer agrees that the Owner will not be responsible for any errors or omissions on the part of the Tenderer in preparing this Tender.

The undersigned Tenderer agrees and offers as follows:

1. The Tenderer understands that the quantities for items given in the Schedule of Quantities are approximate and are subject to increase or decrease. The Tenderer offers to undertake the Work for the Tendered Unit Prices whether the quantities increase or decrease. The Tenderer agrees that the Tendered Unit Prices are firm and that allowances have been made for escalation of costs related to materials, labour, labour-related fringe benefits, equipment, operating costs associated with equipment, etc.

2. If this Tender is accepted within forty-five (45) days from the closing date of the Tender, to enter into a formal Contract and give the specified bonds to secure the performance of the terms and conditions of the Contract. In the event of this Tender being accepted within forty-five (45) days of the Tender closing date and our failure to enter into a Contract in accordance with the terms of our tender, our security, limited to the lesser of the face value of the Bid Bond or the difference between this Tender and the Tender for which the Contract is signed, shall be forfeited to the Owner, in lieu of any damages to which the Owner may entitled by reason of our failure or refusal to enter into such Contract.

3 To begin work on the date specified in the "Notice to Proceed" and to execute the work in such a manner as to complete on or before December 31, 2018. Should the undersigned fail to complete the project within this time, then the undersigned will compensate the Owner for liquidated damages as follows:

a) The Owner's increased costs for contract administration and inspection duties of the Engineer (or other professionals as required by the Owner), as well as the Owner's own staff costs as caused by such delay, an amount per day or pro rata portion of each day as follows:

- Engineering and consulting costs, per person = $800
- Owner's staff costs, per person = $400

and,

b) All direct out of pocket expenses, such as costs for safety, security and equipment rental, as reasonably incurred by the Owner as a direct result of such delay.

4. The Tender price shall include the Goods and Services Tax at the location shown in the Tender Form.

5. Rates to be used on unclassified work and to be all-inclusive.

A) Equipment

Type	Unit and Model Description	All-Inclusive Hourly Rate
Backhoe		$
Excavator		$
Excavator		$
Excavator		$
Loader		$
Tandem Truck		$
Truck and Pup		$
		$
		$
		$
		$
		$
		$

B) Labour

Personnel which may be supplied by the Tenderer for use at the site.

Classification by Trade	All-Inclusive Hourly Rate
Superintendent	$ _____
Foreman	$ _____
Surveyor	$ _____
Pipe Layer	$ _____
Labourer	$ _____
Operator	$ _____
Others (please specify trade):	
_____	$ _____
_____	$ _____
_____	$ _____
_____	$ _____

C) Personnel

Name of Superintendent to be in charge of Project: _____

Previous Experience on similar work:

_____

_____

_____

_____

_____

_____

Number of workers in work force _____

6. Supplemental Information

(A) References and Project Experience

Provide, in the tabulation following, a list of comparable projects undertaken within the last five (5) years:

PROJECT	**LOCATION**	**OWNER**	**CONTACT PERSON** Name & Phone No.

(B) Subcontractors

Provide, in the tabulation following, the name of any subcontractor proposed to be utilized on the project and a description of the component of the work to be subcontracted.

Name and Address of Subcontractor	**Portion of Work to be Subcontracted**

SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SEWER SYSTEM RECONSTRUCTION

SCHEDULES OF QUANTITIES:
Supply and install the following works in accordance with these Contract Documents and Specifications complete with labour, equipment, materials, layout, de-watering, testing, restoration, permits, and incidentals.

ITEM NO.	DESCRIPTION	UNIT OF MEASURE.	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1.0	**Removals**				
1.1	Remove and dispose of existing surface aggregate including concrete and asphalt regardless of thickness, including sawcutting	m²	1330		
1.2	Remove and dispose of existing sanitary manhole during bypass connection (drawing 649-015-12)	ea	1		
1.3	Remove and stockpile 300mm of the existing surface aggregates on Hurley River Rd	m²	810		
1.4	Clear, strip, and grub treatment site including removal and disposal of existing trees (approx. 2000m²)	LS			
1.5	Import, place, and compact local material to 95% SPD to raise effluent bed site to proposed elevations (raise road elevations?)	m³	1000		
		Subtotal: 1.0 - Removals			
2.0	**Sanitary Sewer Collection System**				
2.1	Supply and install Sanitary Sewer Mains at 1-3m depth c/w excavation, class 'B' sand bedding, backfill, and compaction.				
2.1.1	200Ø PVC	l.m.	2050		
2.1.2	150Ø PVC	l.m.	185		
2.2	Supply and install Sanitary Sewer Mains over 3m depth c/w class 'B' sand bedding, backfill, and compaction.				
2.2.1	200Ø PVC	l.m.	140		
2.3	Supply and install sanitary manholes				
2.3.1	Precast 1050Ø base c/w lid, frame, and cover	ea	41		
2.3.2	Precast 1050Ø base c/w lid, markers and steel plate	ea	3		
2.3.3	Precast 1050Ø barrels	v.m.	57		
2.3.4	Precast 1200Ø base c/w lid, frame, and cover	ea	1		
2.3.5	Precast 1200Ø barrels	v.m.	3		
2.4	Supply and install sanitary sewer services				
2.4.1	200x100Ø Sanitary service wye	ea	74		
2.4.2	Sanitary service connection into manhole c/w rubber seal gasket	ea	33		
2.4.3	100Ø Sanitary service inspection chamber at property	ea	107		
2.4.4	100Ø PVC DR28 sewer service including bends, sweeps, and appurtenances, regardless of depth	l.m.	1150		
2.5	Supply and install anchor blocks (joint restraints) between manholes S21 and S20 on dwg 649-015-09	ea	3		
2.6	Construct temporary manhole tie-ins to existing sanitary system c/w bypass pumping, necessary fittings, pipe, excavation and backfill - complete (See details on drawing 649-015-16)				
2.6.1	Whiting Avenue temporary tie-in	LS			
2.6.2	Hawkes Avenue temporary tie-in	LS			
2.6.3	Lillooet-Pioneer Highway temporary tie-in #1	LS			
2.6.4	Marmot Crescent temporary tie-in	LS			
2.6.5	Lillooet-Pioneer Highway temporary tie-in #2	LS			

ITEM NO.	DESCRIPTION	UNIT OF MEASURE.	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
2.0	**Sanitary Sewer Collection System - Continued**				
2.7	Adjust watermain per detail on dwg 649-015-15	ea	6		
2.8	Locate and tie to existing services c/w necessary couplers and fittings	ea	81		
2.9	Cap proposed service at property line c/w plug and marker post	ea	26		
2.10	CCTV Video inspection of 200mm and 150mm sanitary sewer mains	l.m.	2375		
	Subtotal: 2.0 - Sanitary Sewer Collection System				
3.0	**Sanitary Sewer Treatment and Outfall**				
3.1	Supply and install 2-30 cubic meter septic tanks c/w inlet piping and outlet piping to flow meter manhole	LS			
3.2	Supply and install 10 biofilters c/w flow dividers, inlet piping and outlet piping to outflow manhole c/w valves and fittings	LS			
3.3	Supply and install outfall piping to Cadwallader creek from outflow manhole including 150mm C900, 38mm forcemain, service saddle, corp stop, curb stop, check valves and fittings	LS			
3.4	Supply and install flow meter and fittings per detail	LS			
3.5	Supply and install effluent pump including rails, lifting apparatus, float switches and fittings per detail	LS			
	Subtotal: 3.0 - Sanitary Sewer Treatment and Outfall				
4.0	**Restoration**				
4.1	Asphalt roadway restoration c/w 50mm cold mix asphalt, 150mm of 19mm minus crushed gravel base, and 300mm of 75mm minus pit run sub-base including compaction to 100% SPD	m²	500		
4.2	Asphalt roadway restoration c/w 50mm hot mix asphalt, 150mm of 19mm minus crushed gravel base, and 300mm of 75mm minus pit run sub-base including compaction to 100% SPD	m²	350		
4.3	Gravel roadway restoration c/w 100mm of 19mm minus crushed gravel base, and 150mm of 75mm minus pit run sub-base including compaction to 100% SPD	m²	1825		
4.4	Boulevard and trench limit restoration including topsoil and seeding where required	m²	1200		
4.5	Reinstate stacked rock wall following construction	LS			
4.6	Re-establish storm culvert on Hawkes Avenue & Lillooet-Pioneer Hwy	LS			
4.7	Supply and Install 600mm CSP culverts at entrance to treatment site	l.m.	30		
	Subtotal: 4.0 - Restoration				

ITEM NO.	DESCRIPTION	UNIT OF MEASURE.	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
5.0	**Electrical**				
5.1	Supply and install Kiosk and 600v step up transformer c/w concrete base	LS			
5.2	Supply and install 600V direct bury cable c/w sand bedding and marking tape in common trench with sanitary main	l.m.	320		
5.3	Supply and install kiosk on site c/w per detail step down transformer c/w concrete pad and flow meter display	LS			
5.4	Supply and install pump level switches c/w wiring	LS			
5.5	Supply and install pump motor starter and controls c/w wiring	LS			
5.6	Supply and install Pole per detail including base, pole, alarm beacon and solar panels c/w wiring				
			Subtotal: 5.0 - Electrical		

Tender Summary

Subtotal 1.0 - Removals	
Subtotal 2.0 - Sanitary Sewer Collection System	
Subtotal 3.0 - Sanitary Sewer Treatment and Outfall	
Subtotal 4.0 - Restoration	
Subtotal 5.0 - Electrical	
Subtotal Parts 1.0 - 5.0	
Contingency Allowance	**$100,000.00**
GST (5% of Tender Subtotal)	
Total Contract Sum	

7. Receipt is acknowledged of the following addendum(s) covering revisions to the Contract Documents.

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

TOTAL CONTRACT PRICE (written)

_____

_____

_____
Name of Corporation, Partnership or Organization

Legal Status ❒ Corporation ❒ Partnership ❒ Sole Ownership

_____
Correct Mailing Address

_____ _____ _____
Phone Fax GST Registration No.

Names and Addresses of Corporation Officers or Members of Organization

Position	Name	Address
Position	Name	Address

_____ **SIGNED BY** _____
Signature of Witness

_____ **POSITION** _____

_____ **DATE** _____
Address of Witness

❒ **Affix Corporate Seal Here**

CONTRACT AGREEMENT

This Agreement made on the _____ day of _____, 2018.

BETWEEN: **SQUAMISH-LILLOOET REGIONAL DISTRICT**

(hereinafter called the "Owner")

OF THE FIRST PART

AND:

(hereinafter called the "Contractor")

OF THE SECOND PART

WITNESSETH, that the Owner and the Contractor for the consideration hereinafter named, agree as follows:

1.0 SCOPE OF WORK

The Contractor hereby agrees to furnish all of the materials (except as otherwise specified to be supplied by others) and all of the equipment and labour necessary to perform all of the work shown on the drawings and described in the specifications for the project entitled:

BRALORNE SANITARY SEWER RECONSTRUCTION

which drawings and specifications have been prepared by the Owner, or its duly appointed agent, acting as, and referred to herein as the "Engineer" all in accordance with the Documents listed in the "Contracts of the Contract Documents".

2.0 CONFLICTS - See General Conditions - GC-45

3.0 TIME OF COMPLETION

The work to be performed under this Contract shall be commenced within seven (7) calendar days of Notice to Proceed and shall be completed on or before December 31, 2018.

It is understood and agreed that time is of the essence of this Agreement and in the event said work is not completed on or before the date named above for its completion, the Contractor shall pay the added engineering expense and other costs as liquidated damages to the Owner caused by the extra time required for the completion of the work. Extra time shall, in all cases, be construed as the time required for completion after the date named. The amount of such expense shall be deducted from any monies due the Contractor.

4.0 THE CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Contract subject to additions and deductions provided therein, in current funds at the prices named in the Tender Form attached to and a part of these Contract Documents.

5.0 PROGRESS PAYMENTS

The Owner shall make payment on account of the Contract as certified by the Engineer and in accordance with the General Conditions of these documents.

6.0 SECURITY DEPOSIT

The Contractor hereby and herewith deposits with the Owner the following security guarantees:

(1) A Performance Bond including the Contractor's obligations during the maintenance period to the Squamish-Lillooet Regional District in the amount of fifty percent (50%) of the Total Contract Sum, and be in a format consistent with "SAC Performance Bond 2012" as prepared by the Surety Association of Canada and a Labour and Materials Payment Bond in the amount of fifty percent (50%) of the Total Contract Sum, or

(2) An Irrevocable Letter of Credit to the Squamish-Lillooet Regional District executed on the form provided for in these Contract Documents, in the amount of one hundred percent (100%) of the Total Contract Sum for the Performance and Labour and Materials Payment Guarantee.

Upon the express understanding that the same shall be held and retained by the Owner as security for the due and faithful performance, observance and fulfilment by the Contractor of all the covenants, provisions, agreements, conditions and reservations in this Contract contained, on the part of the Contractor to be observed, performed and complied with.

Upon the due and faithful performance, observations and fulfilment by the Contractor of all and every one of the terms provisions, covenants, agreements, conditions and reservations herein contained on the part of the Contractor to be observed, performed and complied with, the Contractor shall be entitled to receive again the said security deposited.

In the event of any breach, default or non-performance, being made or suffered by the Contractor, in or in respect of any terms of conditions, covenants, provisions, agreements or restrictions herein contained which on the part of the said Contractor should be observed, performed, or complied with, the Owner may at his option, if any indemnity bond had been deposited under the terms hereof, enforce said bond.

7.0 SIGNATURES

IN WITNESS WHEREOF the parties hereto have executed this Agreement, the day and year first above written.

SIGNED, SEALED AND DELIVERED
in the presence of:

_____ _____ (SEAL)
(Witness) (Party of the First Part)

_____
(Address)

_____

_____ _____ (SEAL)
(Witness) (Party of the Second Part)

_____
(Address)

_____

G E N E R A L C O N D I T I O N S

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GC-1.0 DEFINITIONS

1.1 The term **Contract Documents** means:

Contract Forms:

- the Tender
- the Contract Agreement
- the Certificate of Insurance
- the Performance Bond
- the Labour and Materials Payment Bond;

Conditions of the Contract:

- the General Conditions
- the Supplementary Conditions;

Specifications;
Addenda;
Contract Drawings;

and any other documents associated with the Contract such as Field Orders and Change Orders.

1.2 The term **Engineer** wherever used in these documents shall mean the representative(s) as may be appointed or authorized by the Owner to act on his behalf for the purposes of this Contract.

1.3 The term **Work** wherever used in these documents shall mean the entire Work, including materials, labour, equipment, transportation, or other facilities or items ancillary to the foregoing, required to be done, furnished, and performed by the Contractor to complete the Contract, in accordance with the Contract Documents.

1.4 The term **Owner** shall mean the Party of the First Part as defined in the Contract Agreement for whom the Work is being undertaken.

1.5 The term **Contractor** wherever used in these documents shall mean the second party to this Contract who has submitted a Tender to perform the Work under this Contract which has been accepted by the Owner.

1.6 The term **Subcontractor** wherever used in these documents shall mean a person neither contracting with nor employed directly by the Owner for doing any of the Work, but contracting with and being employed directly by the Contractor. A person, party or company which only supplies or furnishes materials is not a subcontractor.

1.7 The term **Other Contractor** wherever used in these documents means any person or firm or corporation employed by the Owner other than through the Contractor.

1.8 The terms **Contract Price, Contract Sum, and Tendered Unit Price** are the amount(s) of the Contract as shown in the Tender Form and in the Contract Agreement.

GC-1.0 DEFINITIONS (Cont'd)

1.9 Certificates:

i) A **Progress Payment Certificate** and/or **Progress Payment** is a certificate or document prepared and issued by the Engineer on which progress payments to the Contractor are based.

ii) A **Substantial Completion Certificate** is a certificate or document prepared by the Engineer and signed by the Owner which certifies that a minimum of ninety-eight percent (98%) of the Work is complete and that the Work may be used by the Owner for the purposes intended.

iii) A **Construction Completion Certificate** is a certificate issued by the Engineer and signed by the Owner upon full completion of the Work, including cleanup and rectification of all deficiencies.

iv) A **Final Acceptance Certificate** is a certificate prepared by the Engineer and signed by the Owner within thirty (30) days following the expiry of the maintenance period. A Final Acceptance Certificate is issued provided that all conditions of the Contract are met.

1.10 Correspondence:

i) The term **on receipt of written notice** means the date of delivery of correspondence to the Contractor, if delivered by hand, or the date of delivery of the postal courier or other delivery service.

ii) The term **Notice of Contract Award** is a written notice from the Owner or the Engineer advising the Contractor of the Owner's acceptance of his Tender for the Work.

iii) The term **Notice to Proceed** is written correspondence to the Contractor from the Owner or the Engineer which advises the Contractor that Work may commence.

iv) A **Field Order** or **Field Memo** is written communication from the Engineer to the Contractor requesting changes in the Work, clarifying the Contract Documents, issuing instructions or requesting information.

v) A **Change Order** is a written communication issued by the Engineer setting forth the authorized amount which is to be paid to the Contractor for the changes in the Work covered by a Field order, or the authorized amount which is to be deducted from the Contract Price as a credit on account of the changes in the Work covered by a Field Order.

1.11 The term **Maintenance Period** or **Guarantee Period** is the period of time beginning on the date specified in the Substantial Completion Certificate during which the Contractor is responsible for repairing or correcting deficiencies in the Work.

1.12 The term **Completion Date** is the date by which Work covered by these Contract Drawings shall be completed.

GC-2.0 THE CONTRACT AGREEMENT

2.1 The Contract Agreement shall be signed in triplicate by the Owner and the Contractor.

GC-3.0 DRAWINGS AND SPECIFICATIONS

3.1 The Owner will furnish to the Contractor five (5) sets of Contract Documents including Drawings.

3.2 A set of Contract Documents is to be kept at the site of the Work for reference by the Engineer, the Owner, or other regulatory agencies.

3.3 All drawings, specifications and copies thereof furnished by the Engineer are his property. They shall not be used on other work and, with the exception of the signed Contract Document set, are to be returned to the Engineer on request, upon completion of the Work.

GC-4.0 STANDARD SPECIFICATIONS

4.1 Standard Specifications referred to in these Contract Documents are prepared or compiled by agencies or organizations such as CSA, ASTM, and AWWA. Clarification of the intent of these Standard Specifications may be obtained from the Engineer. Whenever referred to, the current edition at the date of the Invitation to Tender shall apply.

GC-5.0 THE ENGINEER AND THE CONTRACTOR

5.1 The Contractor shall have complete control of his own organization, and the carrying out of the Work, and the method of carrying out the Work.

5.2 The Engineer's efforts shall be directed towards reviewing construction progress, providing interpretation of the Contract Documents and ensuring the Work is carried out expeditiously.

5.3 The Engineer does not guarantee the Contractor's work nor undertake to check the quality and quantity of work on behalf of the Contractor. The Engineer is not responsible to the Contractor for discovering defects in the Work nor for advising the Contractor of defects in the Work.

5.4 The Engineer is, in the first instance, the interpreter of the Contract and the judge of its performance.

5.5 Should the Contractor dispute any decision of the Engineer, the dispute shall be referred to Arbitration in accordance with these General Conditions.

5.6 The Contractor shall notify the Engineer in writing within five (5) days if, in the Contractor's opinion, a decision by the Engineer is in error and not a correct interpretation of the Contract.

GC-5.0 THE ENGINEER AND THE CONTRACTOR (continued)

5.7 If the dispute between the Contractor and the Engineer cannot be resolved and the Engineer decides that the disputed work shall be carried out, the Contractor shall act according to the Engineer's written decision. Any question of change in the Contract Price or extension of time for completion, due to such dispute, shall be decided by Arbitration in accordance with these General Conditions.

5.8 Nothing contained in the Contract Documents shall create any contractual obligation between the Engineer and the Contractor.

GC-6.0 SUBCONTRACTORS

6.1 The Contractor shall preserve and protect the rights of the Owner with respect to any Work performed under the Contractor and shall:

a. require Subcontractors to perform Work in accordance with and subject to the terms and conditions of the Contract Documents; and

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

6.2 All Subcontractors shall comply with the provisions of the Workers' Compensation Act. Confirmation of Workers' Compensation Act coverage for Subcontractors may be requested by the Engineer from the Contractor.

6.3 The Contractor shall employ those Subcontractors proposed in the Tender Form, and accepted by the Owner, for such portions of the Work as may be designated.

6.4 Nothing contained in the Contract Documents shall create any contractual obligation between any Subcontractor and the Owner.

GC-7.0 OTHER CONTRACTORS

7.1 The Owner reserves the right to let other contracts related to the Work.

7.2 The Owner and/or the Engineer shall coordinate the work of Other Contractors insofar as it affects the Work of this Contract.

7.3 The Contractor shall coordinate his work with that of Other Contractors and tie into Works constructed by others as specified or shown in the Contract Documents.

7.4 The Contractor shall report to the Engineer any apparent deficiencies in Other Contractors' work which would affect the Work of this Contract as soon as they come to his attention and shall confirm such report in writing. Failure by the Contractor to so report shall invalidate any claims against the Owner by reason of the deficiencies of Other Contractors' work except as to those of which the Contractor could not reasonably be aware.

GC-8.0 ASSIGNMENT

9.1 Neither Party to the Contract shall assign the Contract or any portion thereof, nor any monies due to either Party, without the written consent of the other.

GC-9.0 INDEMNITY

9.1 The Contractor shall indemnify and save harmless the Owner, from and against all losses and all claims, actions, and judgments brought against him or the Owner by reason of any act or omission of the Contractor, his agents, or employees, in the execution of the Work, which shall include protecting the Work and protecting the public from the hazard arising out of the Work.

GC-10.0 OWNER'S RIGHT TO DO WORK

10.1 Should the Contractor fail or neglect to execute the Work in accordance with these Contract Documents by:

i. refusing or failing to supply proper workmanship, materials, or construction equipment,
or
ii. refusing or failing to rectify deficiencies identified in Field Memos;

then the Engineer may notify the Contractor in writing that he is in default of his contractual obligations and instruct him to correct the default within five (5) working days.

10.2 Where the default cannot be corrected in the five (5) working days referred to in 10.1, the Contractor shall be considered to be in compliance if he commences with the corrective measures and submits a schedule for resolving the defaults which is acceptable to the Owner.

10.3 If the Contractor fails to comply with the provisions 10.1 and 10.2, the Owner may, without prejudice to any other right or remedy he may have, correct such default and may deduct the cost thereof from the payment then or thereafter due the Contractor, provided however that the Engineer shall, in the first instance, determine that both the corrective action and the amount subsequently charged to the Contractor are reasonable.

GC-11.0 OWNER'S RIGHT TO TERMINATE THE CONTRACT

11.1 If the Contractor should:

a. be adjudged bankrupt, or make a general assignment for the benefit of creditors, or if a receiver is appointed on account of his insolvency, or

b. fail to make sufficient payments due to his subcontractors, or suppliers, or

c. disregard laws or bylaws, or the Engineer's instructions, or

GC-11.0 OWNER'S RIGHT TO TERMINATE THE CONTRACT (continued)

d. abandon the Work, or fail to adhere to the Work Schedule to such an extent that there is danger of failing to meet Completion Dates, or

e. otherwise violate the fundamental conditions of the Contract,

the Owner shall, by written notice, instruct the Contractor to correct the default within five (5) working days. If the default is not corrected within five (5) working days, then the Owner may, without prejudice to any other right or remedy he may have, terminate the Contract.

11.2 If the Owner terminates the Contract under the conditions set out above, and if the performance guarantee is unconditional, the Owner shall be entitled to:

a. take possession of the premises and products and finish the Work by whatever method he may deem expedient but without undue delay or expense;

b. withhold any further payments to the Contractor until the Work is finished;

c. upon completion of the Work, determine the full cost of finishing the Work as certified by the Engineer, including compensation to the Engineer for his additional services and a reasonable allowance as determined by the Engineer to cover the cost of any corrections required under the maintenance period, and charge the Contractor the amount by which the full cost exceeds the unpaid balance of the Contract Price; or if such cost of finishing the Work is less than the unpaid balance of the Contract Price, pay the Contractor the difference.

d. on expiry of the maintenance period, charge the Contractor the cost of corrections.

e. If the performance guarantee is in the form of a Performance Bond, the provisions of this General Condition shall be exercised in accordance with the conditions of such Performance Bond. In that event the Surety shall perform the Contract in accordance with all of its conditions including adherence to the Completion Dates in the Contract Agreement.

GC-12.0 CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT

12.1 If the Owner should be adjudged bankrupt, or makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of his insolvency, the Contractor may, without prejudice to any other right or remedy he may have, by giving the Owner five (5) days written notice, hold the Owner in default.

12.2 If the Work should be stopped or otherwise delayed for a period of ninety (90) days or more under an order of any Court, or other public authority, and provided that such order was not issued as the result of any act or fault of the Contractor or of anyone directly or indirectly employed by him, the Contractor may, without prejudice to any other right of remedy he may have, by giving the Owner written notice, hold the Owner in default.

GC-12.0 CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT (continued)

12.3 The Contractor may notify the Owner in writing, with a copy to the Engineer, that the Owner is in default of his contractual obligations if the Owner, subject to requirements of these General Conditions, fails to pay to the Contractor when due, any amount certified by the Engineer.

Such written notice shall advise the Owner that if such default is not corrected within fifteen (15) calendar days from the receipt of the written notice the Contractor may, without prejudice to any other right or remedy he may have, stop the Work and terminate the Contract for fundamental breach.

12.4 If the Contractor terminates the Contract under the conditions set out above, he shall be paid for all work performed and for any loss sustained upon products and construction machinery and equipment, with reasonable profit.

GC-13.0 MAINTENANCE PERIOD

13.1 The Maintenance or Guarantee Period shall begin on the date specified in the Substantial Completion Certificate and is for a period of at least one (1) year.

13.2 The Contractor shall correct, at his own expense, any defects in the Work due to faulty products or workmanship appearing within the Maintenance Period.

13.3 The Owner shall notify the Contractor promptly of such defects. If the Contractor does not cause repairs to be made within ten (10) days after such notice, the Owner shall have the right to purchase materials and employ men to execute said repairs, and the cost of the same shall be the responsibility of the Contractor or his Surety.

13.4 Where repairs must be made immediately by reason of an emergency existing or otherwise, the Owner shall have the right to undertake such repairs and charge the cost of the work to the Contractor, except that the Owner shall immediately notify the Contractor and shall withdraw from the work of repair if and as soon as the Contractor's forces are ready to start work.

13.5 The Contractor shall be responsible for all costs including the cost of engineering required for investigation of any repair of defects in his work.

13.6 At least one month prior to expiry of the Maintenance Period, the Owner shall advise the Contractor of defects which the Contractor is required to remedy, under the Contract, and the Contractor shall promptly remedy such defects.

GC-14.0 ARBITRATION

14.1 In the event of a dispute between the Owner and the Contractor in relation to the stipulations and provisions of this Contract, or to the manner and performance of the whole or any part of the Contract by either of the parties, the matter may be submitted to Arbitration as provided for by the *"Arbitration Act"* of the Province where the Work is situated.

GC-14.0 ARBITRATION (continued)

14.2 Either party initiating action under the Arbitration provisions shall give written notice to the other party.

14.3 The Contractor shall not cause a delay of the Work while the Arbitration proceedings are pending or in progress.

GC-15.0 SCHEDULE

15.1 The Contractor shall submit, prior to the commencement of the Work, to the Engineer, a Work Schedule which shall show the order in which the Contractor proposes to carry out the Work, and estimated dates of completion of each component. The Work Schedule shall be updated by the Contractor as requested by the Engineer.

15.2 If, in the opinion of the Engineer, any Work Schedule submitted is inadequate to secure the completion of the work as specified, or is otherwise not in accordance with the specifications, the Engineer shall have the right to request a revised schedule.

GC-16.0 DELAYS AND EXTENSION OF TIME

16.1 If the Contractor is delayed in the performance of the Work by;

i) labour disputes, strikes, and/or lock-outs beyond his control;
ii) fire, or transportation problems beyond his control;
iii) other unusual event beyond his control;

then the Completion Date shall be extended for a time period equal to the time lost due to these factors. No extension of Completion Date will be made unless the Contractor makes the appropriate request within seven (7) days of the event occurring.

16.2 The factors described in 16.1 shall not be the basis of extra cost claims by the Contractor.

16.3 If the Contractor is delayed in the performance of the Work by failure of the Owner to make decisions respecting the Work, late delivery of materials furnished by the Owner, or acts or omissions of the Owner, the Contractor shall be compensated for any additional costs thereby incurred, and the Completion Date shall be changed. The amount of the compensation and the extent of change in Completion Date shall be determined by the Engineer.

16.4 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 provided that such Order was not issued as a result of any act or fault of the Contractor, or of anyone employed by him directly or indirectly, then the Contractor shall be entitled to claim compensation

GC-16.0 DELAYS AND EXTENSION OF TIME (continued)

for additional costs thereby incurred, and the Completion Date shall be changed. The amount of compensation and the extent of change in Completion Date shall be determined by the Engineer.

GC-17.0 CHANGES IN THE WORK

17.1 The Owner may, as the need arises, order changes in the Work through additions, deletions, modifications, or variations without invalidating the Contract and without notice to the Contractor's surety. The value, if any, of such changes shall be taken into account in ascertaining the amount of the Contract Sum. All such Work shall be executed under the conditions of the Contract supplemented where necessary for varying conditions.

17.2 No extra Work, or change, shall be made unless in pursuance of a written Field Memorandum or a letter request, and no change in the Contract Sum shall be valid without an Extra Work Order.

17.3 The value of any additional Work or change shall be determined in the following manner for either an increase or decrease in the Work:

i) by Unit Prices named in the Contract;
ii) as for "Extra Work" where Unit Prices have not been tendered.

17.4

1. When there is an increase or decrease in the Work not covered by Contract Unit Prices, it shall be known as "Extra Work". The value of such Work may be determined by the following:

    i) On the basis of Personnel and Equipment Rates included on the Tender Form.

    ii) Labour rates not included on the Tender Form will be determined on the basis of actual costs to the Contractor of the labour including additional payroll costs covering Workers' Compensation, Unemployment Insurance, Holiday Pay, Statutory Holidays, Public Liability and Property Damage Insurance and such other payroll costs as may be mandatory according to the laws of the Province in which the Work is being carried out, plus twenty percent (20%) to cover the use of tools, office expense, overhead and Contractor's profit. The services of superintendents, time-keepers, and the like shall be deemed to be included in overhead.

    iii) By Agreement on a Lump Sum or other basis between the Owner and the Contractor.

    iv) In the absence of submitted equipment rates on the Tender Forms, the current Provincial Government Ministry of Transportation and Highways approved rates shall apply. For equipment which has to be brought in for the specific purpose, transportation costs will be paid. A piece of

GC-17.0 CHANGES IN THE WORK (continued)

equipment shall mean a unit complete including operator, fuel, grease and maintenance, and such costs as are normal to an operating unit. Rental shall be paid for actual hours of work only.

v) Supplies and materials will be paid for at invoiced cost plus twenty percent (20%) for overhead and profit.

2. When an "Extra Work" order involves work by a Subcontractor, the payment for materials and services shall be similar to that for the Contractor. The Contractor shall be entitled to a fee of ten percent (10%) for general supervision.

3. Each day on which Extra Work is being done, the Engineer shall, after consultation with the Contractor, complete a force account statement in triplicate indicating the man hours, equipment rental hours and materials used on the Extra Work. Each copy shall be signed by the Engineer and Contractor; with one copy being returned to the Contractor, the second copy used in calculating the actual cost of the Extra Work and the third copy being submitted to the Owner. Extra Work claims not submitted on the day of the Work taking place may not be validated.

4. Extra Work shall be done during normal working hours unless otherwise requested by the Engineer.

5. The Performance Bond shall be extended to cover Extra Work and the guarantee period shall apply to this Work.

17.5 Claims for Extra Work

If the Contractor claims that any instruction by Drawings or otherwise involves extra cost under this Contract, he shall give the Engineer written notice thereof immediately, and he shall then follow the Engineer's instructions regarding proceeding with the Work in question. No such claim shall be valid unless so made. If the Contractor's claim is approved, the procedure shall be as provided for under GC-17.0.

GC-18.0 PAYMENT

18.1 Payment for materials, labour and equipment shall be as set forth in the Contract Documents, and the Engineer, in cooperation with the Contractor, will calculate all progress payments and prepare Certificates for approval and payment by the Owner. Where Unit Prices apply, payment will be calculated on the basis of the Tendered Prices and Units of Work completed, as determined by the Engineer. Where a Lump Sum Price applies, payment will be calculated on the basis of the Engineer's estimated percentage of Work completed. Extra Work payments will be added to the monthly progress payments.

GC-18.0 PAYMENT (continued)

The Owner shall, on or about the twentieth (20th) day of each month, make payment on account of the Contract to the extent of ninety percent (90%) of the value of the labour and materials incorporated into the Work, up to the last day of the previous payment period. The Owner will retain the balance of ten percent (10%) of the value of the Work done in compliance with the requirements of the Builders' Lien Act. The monthly estimates shall not bind the Owner in any manner in the preparation of the final estimate of the Work done, but shall be construed and held to be approximate only, and shall in no case be taken as an acceptance of the Work or as a release of the Contractor from his responsibility thereof.

18.2 Payment Delays

The Owner may withhold or, on account of subsequently discovered evidence, nullify the whole or a part of any Progress Payment Certificate to such an extent as may be necessary to protect himself from loss on account of the following:

a) The Contractor not making satisfactory progress in the opinion of the Engineer;
b) Defective Work not remedied;
c) Claims filed or reasonable evidence indicating probable filing of claims;
d) Failure of the Contractor to make payment properly to Subcontractors or for material or for labour;
e) Damage to another utility or Contractor.

When the above grounds are removed, payments shall be made for amounts withheld because of them.

18.3 Substantial Completion Certificate

Upon receipt of a written notice from the Contractor stating that the Work is substantially complete and ready for inspection (accompanied by a list of the known deficiencies), the Engineer shall promptly make the required inspection, and when he finds the Work to be at least ninety-eight percent (98%) complete and available for the use that it was intended for, then he shall issue a "Substantial Completion Certificate" to the Contractor. This Certificate shall state that the Work provided for under the Contract has been substantially completed, and that the Work may be used for the purpose for which it was intended. Should the Work not be deemed as substantially complete by the Engineer, then a written notice will be given to the Contractor stating the deficiency corrections required for substantial completion.

18.4 Construction Completion Certificate

Upon completion of all project related work items, the Contractor shall notify the Engineer in writing that the project is one hundred percent (100%) completed and request a Construction Completion Certificate for the project. Upon a satisfactory inspection of the Works, the Engineer shall prepare and forward a Construction Completion Certificate to the Owner and to the local approving agencies, for their acceptance of the project and signature on the noted Certificate. The project Maintenance Period will begin on the date of issuance of the Substantial Completion Certificate.

GC-18.0 PAYMENT (continued)

18.5 Final Progress Payment and Builders' Lien Holdback

The final progress payment shall be made after the issuance of the Construction Completion Certificate and in accordance with Paragraph 17.1, and the Contractor has filed with the Engineer, a statement that he agrees with the final quantities as presented and that all claims and demands for Extra Work or otherwise under or in connection with this Contract have been presented and approved for payment, thus establishing the amount of the final payment.

The ten percent (10%) Builders' Lien Holdback payment shall be made after the following conditions have been met:

a. A Construction Completion Certificate has been issued.

b. A Statutory Declaration has been filed with the Engineer by the Contractor certifying that all materials, labour and sub-contract claims incurred, directly or indirectly on account of the Works, have been fully paid by the Contractor and that no lien exists against the premises or materials mentioned herein, for work done or materials furnished in respect of anything done under or by virtue of this Agreement. The declaration shall be filed fifty-five (55) days after the date of issuance of a Substantial Completion Certificate.

c. A statement has been filed with the Engineer from the Workers' Compensation Board certifying that all assessments due by the Contractor have been paid.

d. The Contractor has provided the Engineer with all required invoices, project diaries and required reports.

e. Sufficient deficiency holdbacks have been retained equal to twice the Engineer's estimate of the value of the Works remaining. Part or all of the Builders' Lien Holdback may be retained as a deficiency holdback until such time that the remaining Works have been completed and accepted.

18.6 The Engineer's inspection upon completion of the Work and issuance of the Construction Completion Certificate or Final Payment and Builders' Lien Holdback release do not constitute a waiver of the Guarantee period, nor shall they or attendant acts of the Engineer or the Owner prejudice their rights under any requirement of the Contract, or relieve the Contractor of any of his responsibilities thereunder.

GC-19.0 FINAL ACCEPTANCE CERTIFICATE

19.1 Upon the expiration of the one (1) year maintenance period and the successful completion of tests and satisfactory performance under operating conditions meeting the performance warranty or the requirements of maintenance, as the case may be, the Owner or the Engineer on his behalf shall accept the Works whereupon the Final Acceptance Certificate shall be issued.

GC-19.0 FINAL ACCEPTANCE CERTIFICATE (continued)

19.2 The issuance of the Final Certificate shall not release the Contractor from responsibility for latent defects in his work or materials for which the Contractor may in future be found liable in a Court of Law or otherwise.

GC-20.0 INSURANCE

20.1 Liability

The Contractor shall save and hold harmless the Owner and the Engineer from and against all and any suits or claims alleging damage or injury (including death) to any person or property that may occur or that may be alleged to have occurred, in the course of the performance of this Contract, whether such claim shall be made by an employee of the Contractor, or by a third person and whether or not it shall be claimed that the alleged damage or injury (including death) was caused through the negligent act or omission of the Contractor, its officers, servants, agents or employees or a willful or negligent act or omission of any of its Subcontractors or any of their officers, servants, agents or employees: and at its own expense, the Contractor shall defend any and all such actions and pay all legal charges, costs and other expense arising therefrom.

20.2 Contractor's Insurance

The Contractor shall maintain and keep in force during the term of the Contract and until the date of the Completion Certificate, the following insurance:

- "All Risk" insurance in the joint names of the Owner and the Contractor, in a form and by an insurance company satisfactory to the Owner, for the work and all material, plant, fuel, machinery, tools and equipment acquired, possessed or provided by the Contractor for incorporation into the Work, whether or not such material, plant, fuel, machinery, tools and equipment are brought to or from the Work or upon land of the Owner, in an amount equal to one hundred percent (100%) of the total value of the materials and equipment and work.

- Maintain Public Liability and Property Damage insurance in the amount specified in the Special Provisions of this Contract.

The Contractor shall, at the time the Contract Agreement is signed, submit to the Engineer two (2) copies of the insurance policies required under this Article and shall also provide to the Engineer from time to time, as may be required, satisfactory proof that such policies are still in force and effect.

All insurance companies or policies must be acceptable to and approved by the Owner. Under no circumstances shall the policy be altered in any manner which would affect the interest of the Owner, without thirty (30) days written notice by registered mail to the Owner. When changes in the Contract are sufficient to require insurance additions, the Contractor shall notify the insurance companies and the surety. In the event of the Owner using the completed Works prior to the Construction Completion Certificate, any increase in the cost of insurance arising out of this use shall be at the Owner's expense.

GC-20.0 INSURANCE (continued)

20.3 Insurance Coverage Limits

The Contractor shall, at his sole expense, maintain in effect at all times during the performance of his obligations hereunder, insurance coverages with limits not less than those set forth as follows, with insurers and under forms of policies satisfactory to the Engineer. Prior to commencing this Contract, the Contractor shall furnish the Engineer with Certificates of Insurance as evidence that policies providing such coverages and limits of insurance are in full force and effect, which Certificates shall provide that not less than thirty (30) days advance notice be given in writing to the Engineer prior to cancellation, termination or alteration of said policies of insurance. Such Certificates and Notices shall be sent directly to the Engineer's authorized representative as specified elsewhere in the Contract.

	Coverage	**Minimum Amounts and Limits**
a)	Workers' Compensation	Statutory Limits
b)	Owned Automobile Liability covering bodily injury (including death) and property damage.	$5,000,000 inclusive
c)	Non-owned Automobile Liability covering bodily injury (including death) and property damage.	$5,000,000 inclusive
d)	"All Risk" Contractor Insurance	Contract Sum
e)	Comprehensive Contractor's Liability Insurance to cover bodily injury, property damage and personal injury. This policy of insurance shall be endorsed to include the interests of the Owner, and his Engineers as principals during the performance of this Contract.	$5,000,000 inclusive

GC-21.0 GUARANTY BONDS

21.1 Prior to the signing of the Contract Agreement, the Contractor shall furnish a Performance Bond, and a Labour and Materials Payment Bond in accordance with Article 4 of the Contract Agreement. The Performance Bond shall cover the faithful performance of the Contract including the corrections after completion as provided for in Article 19 of these General Conditions, and the payment of all obligations arising under the Contract, in such form as the Engineer may prescribe. The form of the performance bond shall be "SAC Performance Bond 2012" as prepared by the Surety Association of Canada. The Owner reserves the right to approve or reject any surety company.

GC-22.0 PROTECTION OF WORK AND PROPERTY

22.1 The Contractor shall continuously maintain adequate protection of all of the Work from damage, and protect the Owner's property from damage or loss arising in connection with this Contract. He shall make good any such damage or loss.

22.2 The Contractor shall provide and maintain all passageways, guard fences, lights and other facilities for protection required by public authority or local conditions.

22.3 The Contractor shall protect the property adjacent to the Work from damage as a result of his operations.

22.4 In an emergency affecting the safety of life, or of the Work, or adjoining property, the Contractor, without special instruction or authorization from the Engineer, shall act at his discretion to prevent such threatened loss or injury. Liability for payment of compensation and the amount thereof shall be determined by agreement, or if an agreement cannot be reached, by arbitration.

22.5 If the Engineer becomes aware of an emergency affecting the safety of life, or of the Work, or of adjoining property, and the Contractor, having been advised in writing of the emergency, fails or refuses to act to prevent such threatened loss, injury or damage, or if the Engineer is unable to advise the Contractor, the Engineer may order labour, materials and equipment to be applied to prevent loss, injury or damage. The cost of labour, materials and equipment so used shall be the responsibility of the Contractor, and such action by the Engineer shall not relieve the Contractor of any responsibility for loss, injury, or damage which does occur.

GC-23.0 TAXES AND DUTIES

23.1 The Contractor shall pay all government sales taxes, customs duties and excise taxes with respect to the Contract, unless specified otherwise elsewhere in the Contract Documents.

GC-24.0 PATENT FEES

24.1 The Contractor shall pay all royalties and patent licence fees required for the performance of the Contract. He shall hold the Owner harmless from and against all 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 any patent of invention, by the Contractor, or anyone for whose acts it may be liable.

24.2 In the event that the Contractor claims that, during the performance of the Work, he has encountered a claim for a patent licence fee, for use of a material, process, or method which was specified by the Engineer, and that he was not previously aware that use of such material, process or method was restricted under patent, or that a

GC-24.0 PATENT FEES (continued)

patent licence fee was required, he shall immediately notify the Engineer, in writing, setting out the details of such claim and evidence of his previous lack of awareness of such licence fee being required. The Engineer shall immediately investigate the claim and if it is judged valid, and the material, process or method is used, the Owner shall pay the patent licence fee.

GC-25.0 SURVEYS, PERMITS, AND REGULATIONS

25.1 The Laws and Regulations of the place where the Work is performed shall govern.

25.2 The Owner shall provide all legal surveys except legal surveys required to replace survey pins destroyed or damaged by the Contractor.

25.3 The Contractor shall obtain all Permits, Licences and Certificates, and pay all fees required for the performance of the Work.

25.4 The Owner shall obtain all easements and rights-of-way, and the Contractor shall have free use thereof for the purposes of this Contract, provided that such use shall not interfere with or impede the operation of any other Contractors or workmen employed by the Owner, nor be in conflict with conditions of easement agreement or right-of-way limits.

25.5 The Contractor shall give all required notices, and comply with all laws, bylaws, regulations, codes and orders of all authorities having jurisdiction relating to the Work, to preservation of public health, and to construction safety. If the Contractor observes anything in the Contract Documents to be at variance with the foregoing, he shall promptly notify the Engineer, in writing, and await the Engineer's instructions. If the Contractor performs any work, knowing it to be contrary to such laws, bylaws, regulations, codes or orders, and without giving notice to and requesting instructions from the Engineer, he shall bear all costs arising therefrom.

25.6 The Contractor shall make all arrangements with local authorities, operating departments, railway and highway officials, utility and service companies and such like, for detours, crossings, utility locations, traffic control and similar requirements relating to performance of the Work, and he shall, at his own cost, observe their requirements and regulations.

25.7 The Contractor shall comply with all applicable laws, statutes, regulations, or bylaws of Her Majesty the Queen in Right of Canada, the Province and any local government.

GC-26.0 REFERENCE POINTS AND LAYOUT

26.1 The Engineer will establish base lines and reference points for the location of principal components of the Work, as well as benchmarks in reasonable proximity to the Work.

GC-26.0 REFERENCE POINTS AND LAYOUT (continued)

26.2 The Contractor shall carefully preserve benchmarks, reference points and stakes, and legal survey pins, and in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their loss or disturbance.

26.3 The Contractor shall provide all detailed layout of dimensions, locations, and elevations of the Work from the base lines, reference points, and benchmarks set by the Engineer.

26.4 The Contractor shall not proceed with the Work until he has received from the Engineer such base lines, reference points, elevations, and other points and instructions required for the execution of the Work.

26.5 The Contractor shall, before commencing work at any point, satisfy himself as to the meaning and correctness of all stakes and instructions. No claims shall be considered for any allowance based on alleged inaccuracies, failure to read reference points correctly, or failure to interpret instructions correctly.

26.6 If the Contractor, in the course of the Work, finds any discrepancy between the Drawings and the physical conditions of the locality or any errors or omissions in Drawings or in the layout as given by points and instructions, he shall inform the Engineer immediately in writing, and the Engineer shall promptly verify the same and issue appropriate instructions. Any work done after such discovery, before further work is authorized, will be done at the Contractor's risk.

GC-27.0 COMPLIANCE WITH WORKERS COMPENSATION ACT AND RELATED REGULATIONS

27.1 The Contractor shall be considered as the "Prime Contractor" and "Principal Contractor" in reference to the Workers Compensation Act and Regulations, or other statutes. The Contractor is solely responsible for all safety within the project boundaries.

27.2 Prior to commencing work the Contractor must provide the Engineer with a Notice of Project Confirmation from the WorkSafe BC which identifies the Contractor as the Prime Contractor.

27.3 The Contractor shall ensure compliance on his part and on the part of all of his Subcontractors with the Workers Compensation Act and Regulations thereunder.

27.4 In any case, where pursuant to the provisions of the Workers Compensation Act, an order is given to the Contractor or one of his Subcontractors in respect to their operations under this Contract to cease operations because of failure to install or adopt safety devices or appliances or methods as directed, or required by the Act or Regulations thereunder, or because conditions of immediate danger exist that would be likely to result in injury to any person, and the Contractor is not available or capable of removing the danger to life or equipment resultant from the Contractor's operations, then the Engineer may issue Written Notice to the Contractor and may immediately arrange for the removal of this danger, and the

GC-27.0 COMPLIANCE WITH WORKERS COMPENSATION ACT AND RELATED REGULATIONS (continued)

Contractor shall be liable for the costs of such arrangements, but such act by the Engineer shall not relieve the Contractor of responsibility for injury, loss of life, or damage which may occur in that situation.

27.5 In the event that the Contractor refuses or fails to comply with an order under the Workers Compensation Act or Regulations thereunder, so that the performance of the Work is stopped, the Owner may, upon written notice, terminate the Contract and proceed in accordance with Clause 11.2.

27.6 The Contractor will be responsible for reimbursement of any costs, fines, and penalties incurred by the Owner or the Engineer as a result of the Contractor performing work in breach of any Workers Compensation Act order or regulation.

GC-28.0 CONDITIONS

28.1 In the event that during the execution of the Work, sub-surface conditions at the site are found to differ materially from those indicated in the Contract Documents and soil reports, or otherwise represented by the Owner or Engineer to the Contractor, then the Contractor shall promptly notify the Engineer in writing of such conditions. The Engineer shall promptly investigate such conditions and if he finds that they differ materially and will result in an increase or decrease in the cost of, or time required for, performance of this Contract, an equitable adjustment shall be made between the parties and the Contract modified in writing accordingly. If the parties fail to agree upon the adjustment to be made, the dispute may be determined as provided for in **GC-14**.

GC-29.0 ACCESS ROADS

29.1 The Contractor shall construct and maintain, at his own expense, all roads, accesses and areas required by him for his performance of the Contract, including snow removal. The Contractor shall, as required, obtain necessary permits from appropriate authorities for use of the Provincial roads.

GC-30.0 TOOLS, PLANT AND EQUIPMENT

30.1 If, at any time before the commencement or during the progress of the Work, the tools, plant or equipment appear to the Engineer to be insufficient, inefficient, or inappropriate to secure the quality of work required or the progress, the Engineer may order the Contractor to increase their efficiency, to augment their number or to substitute new tools, plant or equipment as the case may be, and the Contractor must conform to such order. The failure of the Engineer to demand such increases shall not relieve the Contractor of his obligation to secure the quality of Work and rate of progress necessary to complete the Work within the time required by the Contract.

GC-31.0 CONTRACTOR'S UNDERSTANDING

31.0 It is understood and agreed that the Contractor has, by careful examination, satisfied himself of the nature and location of the Work, the soil structure and topography at the site, the nature and quantity of materials to be used, the equipment facilities needed preliminary to and during the prosecution of the Work, and all other matters which can in any way affect the Work under this Contract.

GC-32.0 CONTRACTOR'S RESPONSIBILITIES AND CONTROL OF THE WORK

32.1 The Contractor shall have the required expertise to carry out the Work in a competent manner.

32.2 The Contractor shall have complete control of the Work. He shall effectively direct and supervise the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures, and for coordinating all parts of the Work under the Contract.

32.3 The Contractor shall have the sole responsibility for the design erection, operation, maintenance and removal of temporary structural and other temporary facilities and the design and execution of construction methods required in their use.

32.4 The Contractor shall carefully examine the Contract Documents and shall promptly report to the Engineer any error, inconsistency or omission he may discover.

32.5 Although the Engineer may agree to special methods of carrying out the Work, the Contractor will not be relieved of his responsibility for the result. The Engineer's agreement with such special methods shall not constitute grounds for claims by the Contractor for any additional payment, nor for relief of his responsibility for the methods used.

GC-33.0 INSPECTION OF THE WORK

33.1 The Engineer and his representatives shall at all times have access to the Work whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection.

33.2 If the specifications, the Engineer's instructions, laws, bylaws, or any public authority requires any Work to be specially tested or approved, the Contractor shall give the Engineer timely notice of his readiness for inspection, and if the inspection is by an authority other than the Engineer, of the date fixed for such inspection.

33.3 Inspections by the Engineer shall be made promptly. If any Work should be covered up without approval or consent of the Engineer, it must, if required by the Engineer, be uncovered for examination at the Contractor's expense.

GC-33.0 INSPECTION OF THE WORK (continued)

33.4 Materials to be used in the Work are subject to inspection and approval of the Engineer. Materials condemned as being unsuitable and not in conformity with the specifications, shall be removed from the Work and its vicinity without delay, and if the Contractor fails to do so within forty-eight (48) hours after having been directed by the Engineer, the rejected material may be destroyed or removed by the Owner and the cost of removal shall be charged to the Contractor.

33.5 The Engineer shall inspect the Work in the Owner's interest for the purpose of promoting effective completion of the project until the Construction Completion Certificate is issued, and such inspection or lack of it shall not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract.

GC-34.0 SUPERINTENDENCE

34.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Work site at all times while Work is being performed.

34.2 The superintendent shall be satisfactory to the Engineer and shall be the person named in the Contractor's Schedule of Supervisory Personnel in the Tender and shall not be changed except for good reason and only then after consultation with and agreement by the Engineer.

34.3 The superintendent shall represent the Contractor at the Work site and directions given to him by the Engineer shall be held to have been given to the Contractor.

GC-35.0 LABOUR

35.1 The Contractor shall employ Canadian Labour to the fullest extent possible and shall ensure that no person will be discriminated against because of race, colour, sex, age, religion, or origin.

35.2 Wages and hours of labour employed shall be in accordance with Federal, Provincial or Territorial enactments.

35.3 The Contractor shall at all times enforce discipline and good order among his employees, and shall not employ on the Work any unfit person or anyone not skilled in the Work assigned to him. Any men employed on the Work who become intoxicated, intemperate, disorderly, incompetent, or willfully negligent, shall be removed from the Work site.

GC-36.0 MATERIAL SUPPLIED BY THE CONTRACTOR

36.1 The Contractor shall use materials of Canadian manufacture to the fullest extent practicable.

GC-36.0 MATERIAL SUPPLIED BY THE CONTRACTOR (continued)

36.2 Unless otherwise specified, all materials shall be new, and of good quality. The Contractor shall furnish satisfactory evidence as to the kind and quality of materials. The Contractor shall be responsible for replacement at his own cost of all materials that are found to be defective in manufacture or that have become damaged in handling.

36.3 The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the Work, until it has been incorporated into the completed project.

36.4 Where, in the specifications or Drawings, any material, equipment or method is specified, the Contractor may not use another material, equipment or method unless the Engineer has issued to the Contractor a written authorization for the use. The Contractor shall submit in writing an application for review to the Engineer. All submissions shall be accompanied by sufficient data, including the following:

a. Delivery
b. Manufacture
c. Technical Data and Specifications in accordance with the International System of Units (S.I.) - metric units.
d. Specified material, method or equipment for which the alternative is submitted.
e. Prices in relation to the material; method or equipment specified originally. Where required by the Engineer, samples shall be submitted.

36.5 Whenever alternatives, materials or methods are accepted for use on the Contract, whether as a result of an alternative proposal by the Contractor or an equivalent alternative submitted by the Contractor, the Contractor shall be responsible for making all consequent adjustments, at his own cost, to make the alternative fit into the Work as specified.

GC-37.0 MATERIAL SUPPLIED BY THE OWNER

37.1 The Owner undertakes to provide any such materials as are specifically shown in the Contract Documents as being provided by the Owner.

37.2 It shall be the responsibility of the Contractor to arrange for and schedule delivery and storage of these materials.

37.3 The Contractor's responsibility for material furnished by the Owner shall begin at the time and place of delivery thereof to the Contractor. Materials already on the site shall become the Contractor's responsibility on the date specified in the Notice to Proceed. The Contractor shall be responsible for unloading all owner-supplied material and the Contractor and the Engineer shall jointly examine material furnished by the Owner at the time and place of delivery to the Contractor, and shall prepare a statement of acceptance, specifically noting defective material, and rejecting any such defective material. The Contractor shall sign the statement of acceptance of materials into his charge. Any material furnished by the Owner and installed by the Contractor shall, if found defective, be replaced with sound material

GC-37.0 MATERIAL SUPPLIED BY THE OWNER (continued)

by the Contractor. The Contractor shall, at his own expense, furnish supplies, labour and facilities necessary to remove the defective material and install the sound material in a satisfactory manner.

GC-38.0 STORAGE FACILITIES AND USE OF PREMISES

38.1 The Contractor may use such facilities and areas as the Owner may be willing and able to designate for the storage of material and equipment for the job, without charge to the Contractor.

38.2 Should the Contractor require additional facilities or areas he shall make all the necessary arrangements with the owners and occupants of such other facilities or areas and shall pay all rentals and all damages caused by such occupancy and shall furnish good and sufficient releases by the owners or occupants of such land or premises, before Final Payment is made to him under the Contract.

38.3 The Contractor shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, bylaws, permits or directions of the Engineer and shall not unreasonably encumber the premises with his materials.

38.4 The Contractor shall enforce regulations regarding signs, advertisements, fires, smoking, and storage of inflammable material.

38.5 The Contractor shall not load or permit any part of a structure to be loaded in any way that will endanger its safety.

GC-39.0 SHOP DRAWINGS

39.1 The Contractor shall arrange for the preparation of clearly identified Shop Drawings and submit Shop Drawings in one of the following forms:

a. One (1) copy of a reproducible transparency plus two (2) prints, or
b. Two (2) prints to be retained by the Engineer plus the number of copies required by the Contractor.

39.2 Shop Drawings shall be accurately drawn to scale sufficiently large to show all pertinent features of the item and its method of connection to the Work, and shall have sufficient space for the Contractor’s stamp and the Engineer’s stamp.

39.3 Shop Drawings shall be in accordance with the International System of Units (S.I.) metric units.

GC-39.0 SHOP DRAWINGS (continued)

39.4 Prior to submission to the Engineer, the Contractor shall review all Shop Drawings. By this review the Contractor represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data or will do so, and that he has checked and coordinated each Shop Drawing with the requirements of the Work and of the Contract Documents. The Contractor's review of each Shop Drawing shall be indicated by stamp, with the date and signature of a responsible person.

39.5 The Contractor shall submit Shop Drawings to the Engineer for his review with reasonable promptness and in orderly sequence so as to cause no delay in the Work or in the work of other Contractors. If either the Contractor or the Engineer so requests, they shall jointly prepare a schedule fixing the dates for submission and return of Shop Drawings. At the time of submission, the Contractor shall notify the Engineer in writing of any deviations in the Shop Drawings from the requirements of the Contract Documents.

39.6 The Engineer will review and return Shop Drawings in accordance with a schedule agreed upon, or otherwise with reasonable promptness. The Engineer's review shall be for conformity to the design concept and for general arrangement only and such review shall not relieve the Contractor of responsibility for errors or omissions in the Shop Drawings or of responsibility for meeting all requirements of the Contract Documents unless a specific deviation on the Shop Drawings has been approved in writing by the Engineer.

39.7 The Contractor shall make any changes in Shop Drawings which the Engineer may require consistent with the Contract Documents, and resubmit unless otherwise directed by the Engineer. When resubmitting, the Contractor shall notify the Engineer in writing of any revisions other than those requested by the Engineer.

39.8 Each Shop Drawing will be stamped by the Engineer with the following form of stamp;

REVIEWED ( )
REVIEWED AS MODIFIED ( )
REVISE AND RE-SUBMIT ( )
NOT REVIEWED ( )

This review, by TRUE Consulting Group, is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that TRUE Consulting Group approves the detailed design inherent in the Shop Drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings, or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated to the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all subtrades.

GC-40.0 REJECTED WORK

40.1 Defective Work, which has been rejected by the Engineer as failing to conform to the Contract Documents, whether the result of poor workmanship, use of defective products or damage through carelessness or other act of omission of the Contractor, and whether incorporated in the Work or not, shall be removed promptly from the premises by the Contractor and replaced or re-executed promptly at the Contractor's expense.

40.2 Other Contractor's work destroyed or damaged by such removals or replacements shall be made good promptly at the Contractor's expense.

40.3 If, in the opinion of the Engineer, it is not expedient to correct defective Work or Work not done in accordance with the Contract Documents, the Owner may deduct from the Contract Price the difference in value between the Work as done and that called for by the Contract. The difference shall be determined in the first instance by the Engineer.

GC-41.0 USE OF COMPLETED PORTIONS OF THE WORK

41.1 The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding that the time for completing the entire Work or such portions of the Work may not have expired; but such taking possession of and use shall not be deemed an acceptance of the Work.

41.2 If such prior use increases the cost of the Work, the Contractor shall be entitled to such compensation as the Engineer in the first instance may determine.

41.3 If a planned taking possession of and use of portions of the Work has been stipulated in the Contract Documents, then the Contractor shall have no claim for compensation on that account.

GC-42.0 SAMPLES

42.1 The Contractor shall submit for the Engineer's approval such manufacturers' samples as the Engineer may reasonably require. Samples shall be labelled as to origin and intended use in the Work and shall conform to the requirements of the Contract Documents.

GC-43.0 CLEANUP AND FINAL CLEANING OF WORK

43.1 The Contractor shall maintain the Work in a tidy condition, free from accumulation of waste products and debris caused by his own operations.

43.2 When the Work is fully completed, the Contractor shall remove all surplus products, tools, construction machinery and equipment. He shall also remove any waste products and debris, other than those caused by the Owner, other Contractors or their employees. He shall generally leave the Work site in a neat and orderly condition.

GC-44.0 REMEDIES

44.1 The specific remedies to which the Contractor and the Owner may resort under the terms of the Contract Documents are cumulative and are not intended to be exclusive of any other remedies to which the Contractor and the Owner may be lawfully entitled in a case of breach or threatened breach of any covenant, term or provision of the Contract Documents.

44.2 The waiver by the Owner or Engineer of any breach of any covenant or condition in the Contract shall not be construed as a waiver of any future breach of the same terms of the Contract, and the approval of the Owner or Engineer of any act by the Contractor or Subcontractor requiring the Engineer or Owner's approval shall not be construed as an approval to any subsequent similar acts by the Contractor or Subcontractor.

GC-45.0 CONFLICTS

45.1 In the event of an inconsistency or conflict between the provisions of the Contract Agreement, the Specifications and Drawings, the General Conditions or the Tender Form, or any other Documents or writings, then the governing documents shall take precedence in the following order:

1. Contract Agreement
2. Addenda
3. Special Provisions
4. Tender Form
5. General Conditions
6. Specifications
7. Design Drawings
8. Standard Drawings
9. Instructions to Tenderers
10. Other Documents and/or Writings

SQUAMISH-LILLOOET REGIONAL DISTRICT
BRALORNE SANITARY SEWER RECONSTRUCTION

INDEX

1.0 General

1. These Special Provisions shall be read in conjunction with the Contract Documents and Specifications and shall take precedence over all other clauses and sections of these Contract Documents.

2.0 Scope of Work

1. The Contractor shall supply all labour, equipment and materials necessary to construct the works as shown on the design drawings, including cleanup and restoration of the work site.

2. Costs for mobilization and demobilization are incidental to the work; as such, specific payment will not be made for these items. The Tender Form quantities and prices are to be inclusive of mobilization and demobilization.

3. The Owner reserves the right to adjust the scope of work, including increase/decrease or deletion of quantities shown in the Tender Form. Provision of such alterations is detailed in the General Conditions, Section GC-17.0.

3.0 Provisional Contract Sum

1. The Provisional Contract Sum shall be a fund used solely at the discretion of the Owner or his representative. These funds may be used for extra works other than those specified herein. Unused portions of the Provisional Contract Sum will revert back to Owner.

4.0 Work Schedule and Project Site Meetings

1. Prior to commencement of the Contract, the successful Bidder shall be required to submit a proposed Work Schedule showing clearly the intended progress for each week for the duration of the project.

2. The Contractor shall be responsible for the co-ordination and ordering of all materials and equipment required to complete the project in accordance with the Schedule.

3. The Contractor's project site superintendent shall attend a weekly on-site or teleconference project meetings with representatives of the Engineer, the Owner, and other utility operators as may be necessary. At each project site meeting, the Contractor shall review progress of the preceding week, intended operations during the following week and discuss/review appropriate measures and procedures to minimize nuisance and/or inconvenience to the public. Minimization of inconvenience and/or nuisance to the public shall be an important aspect of the Contractor's operations and work plans.

4. Attendance by representatives of the Contractor at weekly site meetings shall be an incidental item to the work of this Contract and, accordingly, no specific or extra payment shall be made for the Contractor's participation in weekly site meetings.

5.0 Contacts

1. Squamish-Lillooet Regional District Jeff Giffin	Phone – (604) 894-6371 Fax – (604) 894-6526
2. TRUE Consulting Stuart Purves	Phone – (250) 828-0881 Fax – (250) 828-0717

6.0 Materials On-Site

1. No payment will be made to the Contractor for materials stored on-site. Payment will be made for installed materials only, in accordance with Tendered Unit and Lump Sum Prices of the Tender Form.

2. The Contractor shall be responsible for obtaining a suitable site for storage of the Contractor's equipment, materials and other facilities necessary to undertake the work of this Contract. This storage location must be approved by the Owner.

7.0 Protection of Survey Monuments, Bench Marks and Layout

1. Any survey monuments and/or property iron pins damaged or removed by the Contractor by his operations which are deemed to be located outside of the site construction area shall be replaced by the Contractor at his expense.

2. The Contractor shall be responsible for all construction layout from given reference points. A digital design file (AutoCAD format) will be provided by the Engineer for use by the Contractor.

3. If checking of the layout by the Engineer reveals errors in layout, the cost of the Engineer's survey crew (based on actual hours required to survey) will be subtracted from the monthly progress payment.

8.0 Field Quality Control

1. The Owner will retain the services of an independent testing agency and pay for the testing of the following, providing the test results meet the minimum specifications set forth by the Engineer.

    a) Field density tests for compaction and Standard Proctor Density curves of trench backfill, foundation preparation and road base materials.
    b) Coring and density testing of finished asphalt surface.

2. The cost of failed tests because of non-compliance of the work with the minimum requirements of materials and workmanship shall be paid for by the Contractor. The costs of these extra tests will be calculated by the Engineer, based on the invoices submitted to the Owner for testing and will be subtracted from the monthly progress payment.

3. The Contractor shall supply all materials and pay for all pressure testing, infiltration and exfiltration testing of pipelines, as specified in Division 2 – Site Work.

9.0 Dust Control

1. The Contractor is responsible for dust control. Water for dust control will be supplied at no cost to the Contractor at hydrants adjacent to the works. The Contractor shall supply all hydrant wrenches, fittings, valves, hoses as required for his work and utilize a certified backflow preventer. All fittings must be removed from the hydrant at the end of the work day with hydrant caps re-installed.

2. The Contractor must maintain adequate dampness on all "disturbed" areas of the Contract so as to prevent unnecessary dust.

3. When requested by the Engineer or the Owner, the Contractor shall provide and undertake dust control measures on non-working days including but not specifically limited to weekends (Saturdays and Sundays) and statutory holidays.

4. Dust control shall be an incidental item to the work of the Contract and, accordingly, no specific or extra payment shall be made for dust control.

5. Dust levels will be deemed to be unacceptable if the Owner or Engineer deems them to be unacceptable or if the Owner receives any complaints from residents concerning dust.

10.0 Location of Existing Utilities and Compensation for Related Work

1. The design drawings show the approximate location of known existing utilities such as watermains, gas mains, sewer, storm sewers, etc. However, other services may exist and the Contractor shall use care and caution in his excavation operation so as not to break <u>any</u> existing services.

2. Existing services and structures include pipes, culverts, ditches, poles, or other items which are part of an existing drainage or water system, or are part of a gas, power, telephone, T.V. or other program.

3. The Contractor shall establish the locations and state of use of all existing utilities that may represent a conflict to the work of this contract. Specifically, the contractor shall locate the existing water main where the sanitary main is proposed to cross it. The contractor shall confirm the elevation of the existing water and report it to the engineer to determine of grade changes are necessary. The contractor shall supply all labour and materials necessary to locate, protect, remove and/or replace existing utilities.

4. Unless a specific item is included in the schedule of quantities it shall be assumed that the contractor's unit prices shall include any additional expense that may be incurred in doing additional work made necessary by the presence of existing piping, structure, pole-lines, trees, fences, culverts, drainage ditches, or any other above or below ground obstacles and utilities which are encountered during the course of construction.

5. The Contractor will be responsible for any damage that may arise, as a result of the Contractor's negligence in failing to locate and protect these utilities.

6. The location of functioning water valves have been identified on the tender drawings for the contractors information.

10.0 Location of Existing Utilities and Compensation for Related Work (continued)

7. The Contractor is responsible for the co-ordination of his work with all utility companies as well as the Owner.

11.0 Dewatering

1. There will be no specific payment for dewatering. The Contractor shall make allowances in their unit prices for any dewatering which may be required for their construction techniques.

12.0 Temporary Bypass Pumping

1. There will be requirements to temporarily pump gravity sewer flow around the construction activities. There will be no specific payment for bypass pumping. Contractors shall make allowances in their unit prices for any bypass pumping that may be required for their construction techniques.

13.0 Sanitary Service Locations and Connections

1. The location of the existing services as shown on the tender drawings is approximate based on available record data. The contractor is ultimately responsible to locate existing service locations to ensure proposed services are located correctly.

2. Sanitary service connections are to be tied in as they are encountered as the sanitary sewer services cannot be shut down. The contractor is to keep records of each service location, type, size, and connection details.

14.0 Construction Logistics

1. The sanitary sewer system must be constructed such that the existing system continues to operate during construction. The contractor shall prepare an order of construction operations plan to be reviewed and approved by the engineer prior to commencing construction.

15.0 Abandonment of Existing Sanitary Sewers

1. Upon connection of all available sanitary sewer services, the contractor may begin the abandonment of the existing sanitary sewer system.

2. Sanitary sewers shall be abandoned at each manhole by plugging the abandoned sanitary sewer pipes with concrete to eliminate soil from entering the pipes.

3. Sanitary sewer manhole frame and covers shall be removed and disposed of by the contractor. Manholes shall be filled with approved sand material. Manhole components shall be removed up to a minimum of 0.5m below finished ground elevations.

16.0 Adjustment of Appurtenances

1. Payment will be made for the adjustment to grade of existing utility appurtenances such as curb stops, valve boxes, manholes, catch basins, etc. only where provisions for payment are made in the Tender Form.

2. Where no provisions are made in the Tender Form for payment for utility grade adjustment in a specified work area, adjustment of utility appurtenances shall be considered as an incidental item to other components of the work (i.e. matching grade/crossfall to finished asphalt/gravel).

17.0 Traffic Control and Detours

1. The Contractor shall prepare a traffic control plan which must be approved by the Ministry of Transportation and Infrastructure prior to work commencing. A copy of the Ministry of Transportation and Infrastructure permit is attached in the tender documents.

2. The Contractor shall supply traffic control personnel as required to direct traffic to the satisfaction of MoTI, the Engineer and the Owner.

3. Road closure and detour signage shall be placed where required and signed *"Local Traffic Only"*.

4. Local road closures shall be permitted only during the time that the Contractor's equipment and personnel are on-site constructing works. At the end of each working day, access though the construction area for local traffic shall be provided. The Contractor shall be responsible for all necessary temporary detours, barricades, working lights, signs, etc. to the satisfaction of the Engineer and the Owner to maintain safety to vehicular traffic.

5. Any and all detours of traffic around a construction area shall be approved prior to institution by both the Owner and the Engineer. The Contractor may be required to advertise in advance any proposed road closures and/or detours in the local newspaper and/or on the local radio station.

6. It shall be the responsibility of the Contractor to advise representatives of local emergency services including but not specifically limited to fire, ambulance and police and school district of detour plans that have been approved by the Owner and the Engineer.

7. All traffic control measures as specified herein, including traffic control signage, detours, liaison with the public, etc. are considered as an incidental item to the Contract and, therefore, no specific payment will be made for traffic control related items.

8. Failure to adhere to the approved traffic control plan will result in the issuance of a stop work order.

18.0 Geotechnical

1. A geotechnical report including test hole logs is included in the tender package for the contractor's information. The Contractor shall recognize the limitations of the geotechnical report and is responsible for making his own judgement as to the implications of the subsurface conditions and the possible constraints on construction.

2. Rocks encountered which are defined as boulders per the specification will be considered incidental to the trench excavation and earthwork activities.

3. Should bedrock be encountered, works required to remove the bedrock will be treated as extra work.

19.0 Surplus Excavated Materials

1. Surplus material may be stock piled for later use on the sanitary treatment site or shall be loaded and hauled to a suitable disposal site.

2. There will be no extra payment for removal and disposal of surplus excavated material. The contractor shall include all costs related to surplus material in his unit prices.

20.0 Clean Up and Restoration of Project Site

1. The Contractor will be required to clean and restore the entire project site area prior to issuance of a Final Completion certificate.

2. This work shall include but not be limited to removal of all waste materials and garbage, sign restoration, etc.

21.0 Video Inspection of Gravity Sanitary Sewers

1. Following flushing and pressure testing of sanitary sewers as described in Section 2D of these contract documents, all sanitary sewers shall be inspected utilizing video equipment. Two copies of the video inspection report and DVDs or USB memory sticks shall be submitted by the Contractor to the Engineer. Deficiencies in relation to Section 2D of these contract documents which may be identified by the video inspection shall be rectified by the Contractor.

22.0 Coordination with Public

1. The Contractor will be responsible for communicating with affected property owners throughout the project.

2. The Contractor shall prepare and deliver notices for all adjacent property owners prior to work commencing and every two weeks following. The notices shall advise current schedule, expected interruptions, road closures, service interruptions and any other information the property owners may find relevant.

3. Copies of the notices shall be posted on the Squamish-Lillooet Regional District website.

23.0 Adherence to WCB Regulations

1. The Contractor is responsible for ensuring that all WCB regulations are met on-site during the completion of the project. The Contractor shall be deemed the Prime Contractor and shall assume all responsibilities as shown under the Workers' Compensation Act.

24.0 Environmental Considerations

1. All works on the Sanitary Treatment site shall take place per the recommendations of the Environmental Impact Assessment prepared by Western Water Associates. This includes:
    - Wildlife management
    - Air quality management
    - Sediment control
    - Environmental monitoring
    - Vegetation and site restoration

2. Installation of silt fence shall be incidental to the contract

3. A Bird survey may be required at the beginning of construction to identify any trees that may not be removed during construction.

4. All works adjacent to Cadwallader Creek shall be performed in accordance with the Section 11 approval for the project

25.0 Sanitary Treatment Site Work Schedule

1. Stripping of topsoil and stock piling of material are permitted at any time during construction on the Treatment Site.

2. Excavations for tanks, treatment modules and the proposed outfall shall not take place prior to August 15th, 2018 due to the annual freshet.

26.0 Hurley River Road Access

1. The contractor will be required to notify local residents and businesses as well as provide signage during construction on the Hurley River Road.

2. Single lane alternating traffic shall be maintained on the Hurley River Road during construction.

27.0 BC Hydro Coordination

1. The client will make the initial application to BC Hydro and will pay the BC hydro design fees for the contract. The contractor will be required to coordinate all BC hydro works and will act as the main point of contact during construction.

2. BC hydro coordination is incidental to the contract

28.0 Optional Site Meeting

1. There is a non mandatory site meeting scheduled for Tuesday April 17, 2018 at 12 pm - meeting at the intersection of the Lillooet Pioneer Highway and the Hurley River Road. Please RSVP to the contract administrator by Thursday April 12, 2018.

29.0 Site Office, Telephone and Internet connection

1. The contractor is required to provide an area for use by the inspector within their site office. The site office shall include telephone and internet connections. It is preferred that the contractors site office be located in one of the two Townsites.

2. Below are a number of options for both site office locations and accommodation. These options are provided for information only:

Bralorne Pioneer Mines Office Building - This can be reconfigured into office or half/half. Some possibility of putting trailer either in lane beside or behind.

Bralorne Church - http://brvca.ca/office-space-for-rent/ Small office, but could use Hall downstairs when room needed. With phone/internet/heat/electricity

Bralorne Pub – Under new ownership expected to reopen this summer. Potential to park trailer in parking lot.

Gold Dust Motel – Located 10 KM from Bralorne in the town of Gold Bridge. 11 rental rooms (250) 238-2423

Bralorne Adventure Lodge – Sleeps 9 https://bralorneadventurelodge.com/

Tyax Lodge – Offers full service accommodations https://www.tyax.com/

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DIVISION 1 - GENERAL REQUIREMENTS
SECTION 1B - GENERAL SPECIFICATIONS

1B-1.0 GENERAL

1B-1.1 Scope

1. This section shall refer to the general requirements of this Contract and shall read in conjunction with each and every subsequent division and section found in these Contract Documents.

1B-1.2 Contract Drawings and Specifications

1. The location of the work together with the details for the construction shall be as shown on Contract Drawings and/or as described in the Specification. The drawings together with the Specifications form a part of the Contract. Figured dimensions on drawings take precedence over scaled distances and dimensions.

2. In the event of discrepancy between the Contract Drawings and the Specifications, the decision of the Engineer shall be final. The figured dimensions on the plans are taken to be correct, but the Contractor shall be required to check carefully all dimensions of structures and locations prior to commencing work thereon. Should any errors be discovered prior to, or during the course of the work, the Engineer's attention shall be called to same and the proper correction made.

3. The work under all sections of these documents and unless otherwise stated shall include supply of all labour, equipment, materials, and services necessary to supply, construct and complete the work as specified herein. The intent of the Specifications is that a complete job is called for, and that the work shall not be deemed complete until the works are approved to be operating satisfactorily and accepted by the Engineer.

4. The Contractor shall instruct all sub-trades to read these General Specifications. Although these Specifications are separated into titled sections, such sections shall not operate to make the Engineer an arbitrator to establish limits of the Contracts between the Contractor and the Sub-Contractors, nor is it intended that the work of that trade is necessarily limited to, nor inclusive of, all work set forth in that particular section. It is the Contractor's responsibility to delegate and coordinate the work of all trades to produce a complete working project without delay.

1B-1.3 Contours and Profiles

1. Where contours or profiles of the area are shown on the Contract Drawings, they are believed to be reasonably accurate but are not absolutely so.

1B-1.3 Contours and Profiles (cont'd)

Contour or profile elevations shown or specified within these Contract Documents are geodetic unless stated otherwise.

1B-1.4 Codes and Standards

1. All work shall be performed in accordance with the National Building Code of Canada. Materials and workmanship must conform or exceed applicable standards of the Canadian Government Specifications Board, Canadian Standards Association (CSA), American Society for Testing and Materials (ASTM) and other referenced organizations. Standards or codes not dated shall be deemed the edition in force at the time of Tender Submission.

1B-1.5 Temporary Structures and Storage Sites

1. The location and erection of temporary structures and storage sites by the Contractor shall be subject to the approval of the Engineer. The Contractor shall arrange the lease or rental of the property with its Owner, prior to storing of materials or the establishment of any temporary structure.

2. The Contractor shall maintain the temporary structures and storage sites in good order, and on completion of the work shall remove all temporary structures, materials, rubbish and debris from the site. The property shall be left in the same condition as originally found or in a condition satisfactory to the Owner and Engineer.

3. The Contractor shall provide sanitary facilities for his workforce in accordance with the governing regulations. These facilities shall be maintained in a clean and sanitary condition in accordance with the Local Health Regulations.

4. The Contractor shall arrange for the installation of whatever utility he may require. These utilities shall be made available to the Engineer without extra compensation.

1B-1.6 Project Materials

1. The Contractor shall be responsible for the delivery, safe handling and storage of materials furnished or accepted by him, until they have been incorporated into the work. He shall assume all public or private liability for all materials that have been delivered to him. Responsibility of the Contractor for materials furnished by the Owner shall begin at the point of delivery thereof to the Contractor. Materials already on-site shall become the Contractor's responsibility 48 hours after the date of the award of the Contract.

1B-1.6 Project Materials (Cont'd)

2. The Contractor shall examine all material furnished to him at the time of delivery and shall reject all defective material. Any material installed and found defective prior to final acceptance of the work shall be replaced by the Contractor at no additional cost to the Owner.

3. Where the Specifications contain an "or equal" clause or permit a substitute material, a written request for the "or equal" shall be submitted to the Engineer. Detailed drawings, specifications and other supporting data shall accompany the "or equal" request which shall clearly illustrate that the applied for "or equal" material meets or exceeds the material specified.

4. Applications for approval shall be submitted in duplicate and one copy will be returned to the applicant stamped and countersigned "APPROVED" if approval is granted. This approval only extends to those features covered by the submission and the material or equipment may subsequently be rejected if it fails to meet the specifications in other respects. No other act shall constitute approval.

5. All materials shall conform to the standard of quality specified within these Contract Documents. Upon request, the Contractor shall supply affidavits stating that the mill test certificates or laboratory test results on factory manufactured materials substantiate the quality of materials incorporated in the work.

1B-1.7 Contractor Workforce

1. It is to be the Contractor's responsibility to coordinate all the work of the Contract and that it be performed in a conscientious and expeditious manner using good, sound, and acceptable construction procedures.

2. The Contractor shall have supervisory personnel on-site at all times during the construction period, that will monitor, organize and supervise the work. The Superintendents shall have the decision-making authority and shall be able to carry out a continuing liaison with the Engineer.

3. The Engineer shall have the authority to require the removal of any person employed on the work of the Contract, if the Engineer considers that person a hindrance to the successful completion of the works.

1B-1.8 Site Maintenance

1. During the construction period the Contractor must maintain the project on a continual basis. Site maintenance shall include: excavation and backfill limits, dust control, property access, clean-up, surface restoration, traffic control and barricading.

1B-1.9 Dust Control

1. The Contractor shall provide for and maintain dust control at all times wherever:
    - the operation of any equipment necessary to execute the work contained in this Contract causes dust that becomes a nuisance to residents of the area;
    - bare soil conditions are created in performing work included in, or pertaining to this Contract.
2. The Engineer's decision as to what provisions are required to maintain adequate dust control shall be final. There shall be no extra compensation for water, sprinkling equipment, or any other dust control measures taken.

1B-1.10 Clean-up

1. The Contractor shall conduct continuous clean-up and disposal operations that comply with local Municipal Regulations and Bylaws and Provincial and Federal Government Anti-pollution Laws.
2. The construction areas shall be maintained free of accumulations of excess or waste material and debris. By the end of each day the construction area shall be cleaned up to near original condition and by the end of the project all areas shall be restored.
3. The disposal of waste materials and rubbish by burning or burial on the site will not be permitted. The disposal of volatile wastes such as mineral spirits, oil, gas, or paint thinner into storm or sanitary sewer drains will not be permitted.

1B-1.11 Existing Utilities

1. Excavations near or adjacent to existing properties, utilities, structures, services, sidewalks, trees, power poles, etc. shall be done with due care and caution. The Contractor shall be responsible for and make good any resulting damage. The Contractor's machinery shall be operated in such a way to prevent damage to life and property.
2. The existence and location of all utilities including both underground, surface and overhead utilities shown on the drawings is not guaranteed, nor is it guaranteed that all utilities which may be encountered are shown. Notwithstanding any other provisions of this Contract, the Contractor will be responsible for locating all the utilities and paying for any damage that he causes to them, or any property damage resulting from his encountering of them.
3. The Contractor shall notify the authority having jurisdiction over each utility one week in advance of his anticipated plan to carry out work in the vicinity of that utility. He shall also arrange, if required, for a representative of the utility company to be present at the time the work is being carried out, at no cost to the Owner.

1B-1.11 Existing Utilities (Cont'd)

4. The Contractor shall protect and support all underground and surface structures and all utilities, utility services and appurtenances and all other obstructions that may be encountered during the construction of the project, at no extra cost to the Owner. Damage to any of these items shall be required and restored at the Contractor's expense.

5. The Contractor shall adequately support the existing utility while crossing under it and shall backfill between the new utility and existing utility with sand compacted in not more than 6 inch layers.

6. The Contractor shall, when requested by the Engineer, excavate to determine the elevation and location of any utility which may cross the alignment of the proposed work at no extra cost to the Owner.

7. The Owner shall pay for any alterations to the existing utility or new work necessary, in the opinion of the Engineer, to facilitate the crossing of existing utilities which intersect the line of the new work; provided however that the Contractor cooperates with the provisions found in the preceding section for establishing locations of existing utilities. Authorization for the method of altering and the arrangements for payment shall be given in writing by the Engineer.

8. When utilities are to be moved, the Contractor shall arrange with the utility company or Owner for the alterations necessary and shall notify the Engineer of such arrangements. The Owner shall pay the moving of the utilities provided the Contractor cooperates with the provisions of Section 1B-1.11.6 for establishing locations of existing utilities.

1B-1.12 Surveys

1. The Contractor will be responsible for the field layout and staking of all existing or proposed utilities including sewer, water, power, telephone and roadways. The Contractor must have in his employ a qualified utility layout man that will prepare cut sheets and place alignment and grade stakes for the required municipal work.

2. The forms for preparing the cut sheets and grade sheets will be provided by the Engineer and must be completed in triplicate by the Contractor and submitted to the Engineer for approval. The Contractor must provide the completed cut sheet to the Engineer at least 24 hours prior to the start of the work for which the cut sheet and field layout has been prepared.

3. The Engineer will make "random checks" on the Contractor's work and will check the layout to ensure that the intent of the Contract Documents and Drawings are adhered to. The Engineer will not be responsible for survey errors that are made by the Contractor during the course of his survey and layout duties.

1B-1.12 Surveys (Cont'd)

4. Payment for sections of work that did not have cut sheet approval from the Engineer prior to their installation will not be approved until the Contractor has assured the Engineer as to the accuracy in alignment of the installed utility.

5. The Contractor shall provide the layout people, equipment and materials at no extra cost to the Owner. The Contractor shall provide the Engineer with assistance, as required, to aid him in checking the layout surveys and the grades of the installed utilities. The surveyors and the Engineer's assistants provided by the Contractor shall be the same person or persons at all times for the project duration, or as otherwise approved by the Engineer.

6. The Engineer will make available to the Contractor, on request, the legal information required, the benchmarks required, and the preliminary survey work that has been prepared prior to Tender Call.

7. The Contractor shall bear the costs of re-establishing all survey pins or benchmarks that were damaged or destroyed by him during his construction operations.

8. If any questions should arise during the Contractor's layout of the work or if the actual layout seems to contradict what is shown on the drawings and mentioned in the Contract Documents, or the layout of any utility wanders from a road right-of-way or easement, or if any obstruction exists along the line of the utility alignment, then the Contractor must cease his layout work and notify the Engineer immediately. The Engineer will then provide assistance to the Contractor in order to solve the discrepancy.

1B-1.13 Explosives and Blasting

1. The handling, storage, transportation and usage methods for explosives shall comply with all Municipal, Provincial and Federal Regulations. The Contractor shall use qualified personnel with a valid Blaster's Ticket to undertake any blasting operations. The Contractor shall take complete responsibility for any damage that may result from the blast.'

2. Approved blasting signals shall be used at all times. All blasting shall be carried out to Workers' Compensation Board Regulations.

3. When necessary to protect property or facilities, all blast areas shall be suitably covered with approved protective material in such a manner as to prevent projection of debris. The Contractor is fully responsible for the method used in blasting rock.

1B-1.13 Explosives and Blasting (cont'd)

4. The quantity of explosives used shall be carefully controlled to prevent damage to rock behind and below the final grade lines and slopes.

5. If requested by the Engineer, the Contractor shall submit a drilling and loading pattern for blasting in advance of the drilling.

6. The Contractor shall have adequate Comprehensive General Liability Insurance endorsed for blasting operation to the value of that requested in the Special Provisions. The Contractor shall contract the various utility Owners to ensure that a conflict does not result when blasting.

1B-1.14 Holidays and Hours of Work

1. The Contractor shall not work on Sundays or on days normally observed as a holiday in a local area without the written approval of the local Municipal Government and the Engineer.

2. The regular hours of work of the Contractor within populated areas shall be restricted between the hours of 7:00 a.m and 6:00 p.m.

1B-1.15 Construction Safety Measures

1. The Contractor shall observe and enforce all construction safety measures as specified by the National Building Code of Canada, the Workers' Compensation Board and applicable Municipal Regulations. In the event of conflict between any provisions of the above authorities, the most stringent provision shall apply.

1B-1.16 Daily Work Record

1. The Contractor shall maintain a daily record of the progress of the work from the date of the commencement of the work. This record shall be open to the Engineer's inspection at all reasonable times and turned over to him on completion of the work. All pertinent data such as daily weather conditions, excavation work, pipe laying, backfilling, erection and removal of forms, concrete pours, sub-trade work, commencement and completion, etc., shall be recorded in this diary.

1B-1.17 Testing

1. The Contractor shall cooperate with the Engineer in the testing of the following:

    - soils-compaction and moisture content tests;
    - concrete-slump, air entrainment and compressive strength test;
    - watermain and appurtenances - pressure and leakage tests;
    - sewermain and appurtenances - infiltration and exfiltration test.

2. The Contractor shall provide all equipment, tools, labour, materials and other incidental and miscellaneous items required to undertake the testing programs as specified within these Contract Documents.

3. The Contractor shall give the Engineer 24 hours notice prior to inspection and witnessing of tests conducted on watermains, sewermains and specialized equipment systems.

4. The Contractor shall have previously tested the watermain, sewermain or specialized equipment system prior to calling for the Engineer to ensure satisfactory test results.

5. The Contractor will be assessed the Engineer's cost for re-witnessing tests that were initially unsuccessful.

6. Tests on watermains and sewermains will be done on sections of the overall system. A section will be defined as follows:

a) watermains: between two consecutive valves and shall include services and appurtenances;
b) sewermains: between two consecutive manholes or manhole and cleanout and shall include services and appurtenances.

7. Tests on watermains, sewermains and specialized equipment systems may be conducted over more than one section, however, the overall test leakage rate for the combined section test shall not be greater than the lesser of the allowable tolerance calculated for each individual test section.

8. Testing of soils, gravel, asphalt and concrete will be carried out in accordance with the related sections of the Contract Documents.

    - the Owner shall pay for successful tests only. The cost unsuccessful tests will be the responsibility of the Contractor;
    - the Engineer reserves the right to order the number and location of additional tests required, should initial tests fail to comply with the specifications herein;
    - all material testing shall be made by a testing laboratory engaged by the Owner.

1B-1.18 Site Meetings

1. The Contractor shall attend regular site meetings as requested by the Engineer.

1B-1.19 Survey Control

1. The Engineer will be responsible for the accuracy of benchmarks and monuments designated as such to the Contractor. All horizontal and vertical measurements shall be given in metres and thousandths of a metre.

2. The Engineer will, upon 24 hours notice, either approve or disapprove the grade sheets and alignment of the Contractor's layout work. The Engineer will not approve payment for work undertaken without his prior approval of the grade sheet and field layout for the work, and will not authorize payment until the Contractor has satisfied the Engineer as to the accuracy of the prematurely installed works.

3. The Engineer will undertake random checks of the Contractor's layout work to satisfy himself as to the accuracy of the ongoing work.

1B-1.20 Inspection

1. All work undertaken by the Contractor shall be subject to inspection. The Contractor shall notify the Engineer not later than 24 hours in advance of the commencement of the work. Work done without notification may be required to be uncovered at the Contractor's expense to allow proper inspection.

2. The Engineer reserves the right to order the discontinuance of the use of any equipment or construction procedure which does not or will not, in his opinion, produce the specified results, or which may cause property damage.

3. If any portion of the work is not being constructed properly in accordance with the Contract Documents, the Engineer reserves the right, upon issuance of notice in writing to the Contractor, to order the operations to be discontinued. No payment shall be made for work performed after such notice has been issued, until all necessary reparations to the work have been made and the Contractor is conducting his operations in accordance with the Contract Documents.

4. If any portion of the site is not being properly maintained in accordance with these Contract Documents, the Engineer will issue a written notice to the Contractor to have the required maintenance work done. If within four (4) hours after issuance of the written notice the required maintenance work has not been started, the Engineer shall have the right to have the required maintenance work done by others at the Contractor's expense.

1B-1.21 Measurement for Payment

1. The quantities of work performed by the Contractor will be computed by the Engineer on the basis of measurements taken by him.

2. Full Contract amounts for each payment item found in the Schedule of Quantities shall only be paid after any section of the utility has been completely installed, in accordance with the measurement and payment clauses found in a subsequent section of this Contract Document. A percentage of the quantity of work done by the Contractor as decided by the Engineer will be deducted from each monthly progress estimate until the work is complete and ready to be put into service.

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DIVISION 1 - GENERAL REQUIREMENTS
SECTION 1C - ALTERNATIVES

1C-1 Scope

This specification refers to Alternative materials, systems, and/or construction procedures that the Contractor might propose to use in the execution of the Work under this Contract.

1C-2 Basis for Acceptance

Acceptance or rejection of alternatives will be based on an evaluation by the Engineer which will consider:

a) Cost savings to the Owner.

b) Equivalent or superior performance to the materials, and/or systems specified in the Contract Documents.

c) Compatibility with other components of the Work.

d) Effects on the proposed Construction Schedule and the progress of the Work.

1C-3 Alternative Submission and Acceptance Prior to the Tender Closing Date

1. If an alternative material or system is proposed prior to the Tender Closing Date, an application requesting approval of the alternative shall be made in writing to the Engineer a minimum of seven (7) days preceding the Tender Closing Date.

2. The submission shall include specification sheets and other product or system data which substantiates the equivalency of the alternative requested.

3. The Engineer will evaluate the alternative submission and issue acceptance in writing within five (5) days of Tender Closing Date. Notification of the acceptance may be issued in the form of an Addendum to the Tender Documents.

1C-4 Alternative Submission and Acceptance On the Tender Closing Date

1. A request for alternatives may be submitted at the time of the Tender Closing. This alternative submission shall clearly set out the following:

    - exact alternative materials or systems proposed with clear description of which Tender Form items the proposed alternatives will affect.
    - specification sheets or other data substantiating the equivalency of the alternatives requested.
    - in a format consistent with the Tender Form, a statement of cost savings to be achieved by the alternative proposed.

2. When an alternative is submitted at the time of Tender without prior approval of the Engineer in writing, the Tender Form and related documents shall be completed on the basis of the Contract Documents and the systems and materials as specified.

3. The alternative submission will be evaluated by the Engineer after the Tender Closing Date. The Contractor will be advised in writing of the acceptance or rejection of the alternatives proposed together with documentation defining Contract Award. If the alternative is accepted, the Contract Documents shall be revised to reflect the alternative proposed together with revisions to the Tender Form payment items offered by the Contractor at the time of Tender submission.

1C-5 Alternative Submission and Acceptance After the Tender Closing Date and Award of Contract

1. A request for alternatives shall be made in writing to the Engineer supported by documentation as described in Item 1C-3 of these specifications. In addition to the technical documentation, the Contractor shall provide information on cost savings which will result from acceptance of the alternative.

2. The alternative will be evaluated by the Engineer in accordance with Item 1C-2 of these specifications.

3. If accepted, the Contractor will be notified in writing by the Engineer in the form of a Change Order with the cost savings in relation to items in the Tender Form defined.

Tenders will be evaluated under full consideration of adopted alternatives.

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DIVISION 2 - SITEWORK
SECTION 2A - EARTHWORK

2A-1.0 GENERAL

2A-1.1 Scope

1. This section refers to clearing and grubbing, excavation, construction of embankments, and miscellaneous grading.

2A-1.2 Related Specifications

1. 1B - General Specifications
2. 2B - Trench Excavation and Backfill
3. 2K - Rock Blasting

2A-2.0 MATERIALS

2A-2.1 General

1. All materials shall be approved by the Engineer prior to the Contractor's construction of the embankment area. All materials shall be classified according to the following categories:

2A-2.2 Topsoil

1. Shall be soil containing organic material, free of large roots, and free of cobbles (25mm maximum diameter) and which, in the opinion of the Engineer, is suitable for landscaping.

2A-2.3 Rock

1. Blast Rock is defined as any solid ledge rock formations of homogeneous sedimentary, igneous or metamorphic material which cannot be excavated or removed by an Excavator of 38,400 kg (equivalent to 235 Cat) with a single tooth ripper which, in the opinion of the Engineer, requires drilling and blasting for removal, and detached boulders of 1 cu.m or more which cannot be removed by means of heavy duty mechanical excavating equipment having a bucket. Frozen materials are not classified as rock.

2. Rippable Rock shall include all forms of rock that can be loosened and removed with ripping equipment. Ripping equipment shall consist of a machine of size and power equivalent to a Caterpillar D-8-H equipped with a double tooth parallelogram ripper, or in trenching, an Excavator of 38,400 kg (equivalent to 235 Cat) with a single tooth ripper.

3. Boulders shall include detached masses of rock with a volume of one (1) cubic metre or greater.

2A-2.0 MATERIALS (Cont'd)

2A-2.4 Common Excavation

1. Common Excavation shall be any material which is not topsoil, blast rock, rippable rock, boulders, or waste material.

2A-2.5 Common Borrow

1. Common borrow shall consist of sandy or silty clay, silty sand, pitrun gravel, or fragmented blast rock, obtained from borrow pits. Common borrow material shall be free of topsoil, organic materials, and debris. The use of common borrow material will only be permitted for use after the source of common excavation material has been depleted, unless otherwise instructed by the Engineer.

2A-2.6 Select Fill

1. Select fill shall consist of imported, graded, granular materials supplied by the Contractor in accordance with the gradation specified, or as instructed by the Engineer. The use of selected fill material shall be only at the written authorization of the Engineer.

2A-2.7 Waste Material

1. Waste material shall consist of excess common material, or material which is unsuitable for embankment construction due to saturated, unstable, or otherwise unsuitable characteristics as determined by the Engineer.

2A-3.0 PREPARATION FOR EARTHMOVING

2A-3.1 Scope of Work

1. The Contractor shall supply all material, labour, and equipment necessary to clear and prepare the site prior to earthmoving.

   The Contractor shall not begin excavation and embankment operations until the preparation operations have been approved by the Engineer.

2A-3.2 Clearing, Grubbing, and Site Preparation

1. Working within the approved stakes, the Contractor shall clear and grub the work site of foreign material, vegetation, and designated trees, or as instructed by the Engineer. All merchantable timber shall be the property of the Contractor and shall be marketed in accordance with Forestry regulations. All vegetative cover shall be removed immediately prior to construction activities. Trees and special areas to be preserved shall be clearly marked to avoid damage. Damaged trees shall be replaced.

2A-3.0 PREPARATION FOR EARTHMOVING (Cont'd)

2A-3.3 Disposal of Materials

1. All unwanted materials, and those derived from the clearing and grubbing operations, shall be disposed of at a site designated by the Contractor, and approved in writing by the Engineer.

2. If the unwanted material is to be disposed of by burning, then the Contractor shall obtain the necessary permits, and shall abide by the rules of the permits in the burning operation.

2A-3.4 Stripping and Storing Topsoil

1. The Contractor shall remove and store topsoil away from the working area. Care shall be taken in removing the topsoil to avoid mixing with the sub-soil or other materials. The topsoil shall be placed in stockpiles in areas designated by the Engineer.

2A-4.0 EXCAVATION AND EMBANKMENT

2A-4.1 Scope of Work

1. The Contractor shall supply all material, labour, and equipment necessary for excavating and construction of embankments.

2. The Contractor shall undertake all excavation and embankment procedures in accordance with the stakes, the cross-sections shown on the Contract Drawings, the Engineer's instructions, and the Contract Documents.

3. The Contractor shall not disturb in any manner, areas that fall outside the lines established by the Contractor's approved stakes.

4. The Contractor will be assessed replanting damages by the Engineer for unnecessary disruption to areas, or for causing damage to areas that fall outside the lines established by the Contractor's approved stakes.

2A-4.2 Embankment Construction and Compaction

1. Embankments shall be constructed by placing, shaping, and compacting approved materials as specified in this specification. All materials placed in embankments shall be bladed smooth in level layers not exceeding 300mm maximum depth over the entire embankment area, and placed in successive uniform layers.

2. When embankments are to be made on hillsides, or where a new fill is to be added to an existing embankment, the slopes of the original ground or embankment (with the exception of rock embankments) shall be terraced or stepped before the new fill is placed.

2A-4.0 EXCAVATION AND EMBANKMENT (Cont'd)

2A-4.2 Embankment Construction and Compaction (Cont'd)

3. Each layer shall be compacted with approved equipment to 95% of Standard Proctor Density, or as noted in the Special Provisions.

4. The Contractor shall have adequate watering and compaction equipment required to efficiently and properly compact the material at the rate the material is being hauled to the embankment area.

5. The embankment shall be constructed with adequate drainage protection. Should the embankment become damaged or saturated by rain, flooding, or other effects, the Contractor shall repair, scarify, or undertake whatever measures are required to restore the embankment to the moisture and compaction requirements of these specifications at the Contractor's expense.

6. Unsuitable materials encountered in the excavation areas, or at the subgrade elevation of the embankment, shall be excavated and wasted at sites designated by the Contractor and approved by the Engineer. Where required, the waste material shall be replaced with common borrow or select fill as directed by the Engineer.

7. Over-excavations shall be rebuilt to grade with an approved material and compacted to the satisfaction of the Engineer at the expense of the Contractor.

8. At transition sections where the profile changes from embankment to cut, the natural slope (except solid rock slopes) shall be excavated to a depth of one (1) metre and replaced with suitable material for a distance of 15 metres to minimize future differential settlement.

9. A tolerance of constructed elevations with respect to design elevations ±50mm will be permitted on all areas except road carriageways and parking lots, where the allowable tolerance is ±25mm.

2A-4.3 Rock Excavation

1. Rock excavations shall be undertaken in accordance with the Contract Drawings, these specifications, and as directed by the Engineer. Rock cuts shall be excavated to a reasonably smooth and uniform surface. All rock cuts shall be brought to subgrade by backfilling with common excavation material.

2. Complete and continuous precautions shall be taken by the Contractor during blasting operations to prevent any damage to persons, vehicles, power or communication lines, structures, or other installations by reason of concussion, vibration, or flying material. The following precautions shall be taken.

    a. The explosives shall be carefully controlled so that blasts shall not damage the rock behind the final grade lines and slope lines.

2A-4.0 EXCAVATION AND EMBANKMENT (Cont'd)

2A-4.3 Rock Excavation (Cont'd)

b. If required by the Engineer, the Contractor shall submit a drilling and loading pattern for blasting in advance of drilling.

c. Approved blasting signals shall be used at all times. All blasting shall be carried out to Workers' Compensation Board Regulations.

d. Where necessary to protect property or facilities, all blasting shall be suitably covered with approved protective material in such a manner as to prevent projection of debris. The Contractor is fully responsible for the method of blasting used.

3. Overbreak in solid rock shall be material excavated, displaced, or loosened outside the specified lines regardless of whether the overbreak is due to the inherent characteristics of the rock formation or to any other cause.

   Overbreak shall be removed and disposed as directed by the Engineer, and approved backfill placed in the resulting excavation.

2A-4.4 Cut and Fill Slopes

1. Unless otherwise specified, embankment slopes shall be constructed to a minimum slope of 1.5H:1V, and cut slopes shall be cut to a minimum of 1.5H:1V.

2. Rock slopes shall be constructed to a minimum slope of 0.25H:1V.

2A-5.0 BORROW PITS

2A-5.1 General

1. Unless specified otherwise within the Special Provisions, the Contractor shall locate suitable borrow pits for the supply of common borrow and select fill materials. The Contractor shall determine the quantity and quality of his intended source of supply of materials. Test results substantiating the quality of materials shall be submitted to the Engineer for his approval. The quantity of material will be determined by quantitative cross-sectional survey.

2A-6.0 TESTING

2A-6.1 General

1. A Standard Proctor Density determination shall be required for each type of material to be used in construction of an embankment. The frequency and type of compaction tests shall be at the discretion of the Engineer, but no more than as outlined below.

   Embankments - one test per 300mm of fill per 500 square metres.

   Subgrade - one test per 300 square metres of subgrade.

   Soft Spot Repair - one test per 300mm of backfill (to a maximum of 100 square metres, and then embankment requirements apply).

2A-7.0 MEASUREMENT AND PAYMENT

1. Unless otherwise specified in the Contract Documents, measurement of earthworks will be done by the cubic metre, square metre by a defined depth, or by the tonne as outlined in the Schedule of Quantities.

2. Payment shall include all field layout, grade or cut/fill sheet preparation, equipment, labour, watering, dewatering, drainage protection of the work area, materials, royalties, pit development, proof rolling, cleanup, and all other incidental items to complete the work in accordance with the Contract Documents and Drawings.

2A-7.1 Clearing and Grubbing

1. The horizontal area cleared and grubbed shall be measured and calculated and the unit expressed in square metres or hectares.

2. Payment for clearing and grubbing shall be made at the Contract Unit Price per square metre or hectare.

2A-7.2 Topsoil Removal

1. Measurement of topsoil shall be measured with one of the two following methods:

   a) Topsoil shall be considered as common excavation and shall be included with the calculations as described below.

   b) Topsoil will be horizontally measured and payment made on a square metre basis. The average depth of the topsoil will be determined by field measurement by the Engineer.

2A-7.2 Topsoil Removal (Cont'd)

2. Payment for topsoil shall include stockpiling at the site or sites designated by the Engineer, and shall be determined by one of the two following methods.

    a) Topsoil shall be paid at the Contract Unit Price per cubic metre as common excavation, and shall be included in the common excavation volume.

    b) Payment for topsoil removal shall be made at the Contract Unit Price per square metre, based on an average depth of topsoil determined by field measurement by the Engineer. The average depth of topsoil will be specified in the Contract Drawings and/or Contract Documents.

2A-7.3 Common Excavation

1. Common excavation will be measured by cross-sections from the ground line as it exists after clearing and grubbing operations have been completed. Quantities shall be measured in cubic metres to the neat lines staked. The method of average end areas shall be used to calculate volumes.

2. Payment for common excavation shall be made at the Contract Unit price per cubic metre.

2A-7.0 MEASUREMENT AND PAYMENT (Cont'd)

2A-7.4 Waste Materials

1. Quantities for waste materials will be measured in excavation as defined in **2A-7.3** for common excavation.

2. Payment for waste material shall be made at the Contract Unit Price per cubic metre for excavation and disposal.

2A-7.5 Common Borrow

1. Common borrow will be measured in excavation using the method outlined in **2A-7.3** for common excavation.

2. Payment for common borrow from on-site or off-site borrow pits shall be full compensation for excavation, royalties, transportation, and placement and compaction in accordance with the Contract Drawings and Documents. Payment shall be at the Contract Unit Price per cubic metre. There shall be no payment for overhaul of this material unless called for in the Schedule of Quantities.

2A-7.6 Embankment Construction

1. Embankment volumes will be measured as in-place, compacted materials expressed in terms of cubic metres within the lines and grades shown on the drawings. No payment will be made for material placed outside the design lines. Embankment volumes will be calculated by the Engineer using cross-sections surveyed by the Engineer.

2. Payment for embankment construction shall be at the Contract Unit Price per cubic metre in place. This payment shall be full compensation for royalties, loading, transportation, placing, and compacting. There shall be no payment for overhaul of this material.

2A-7.7 Select Fill

1. Unless otherwise stated in the Special Provisions, all select fill will be measured in-place and compacted using the method as described in **2A-7.6** for embankment construction.

2. Payment for select fill shall be at the Contract Unit Price per cubic metre or per tonne (as outlined in the Schedule of Quantities) in-place. This payment shall also be full compensation for royalties, loading, transportation, dumping and placing. There shall be no payment for overhaul of this material.

2A-7.8 Blast Rock and Rippable Rock

1.

   a) All quantities for blast rock shall be calculated in cubic metres to the neat lines staked. Upon removal of overburden, cross-sections will be prepared. Quantities shall be computed in cubic metres by the method used in **2A-7.3** for common excavation.

   b) Boulders over one cubic metre in volume shall be measured when exposed.

   c) All quantities for rippable rock shall be considered as common excavation. No separate payment will be made for rippable rock.

2. Payment for blast rock, boulders, and rippable rock shall be made at the Contract Unit Price per cubic metre.

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SECTION 2B - TRENCH EXCAVATION AND BACKFILL
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DIVISION 2 - SITEWORK
SECTION 2B - TRENCH EXCAVATION AND BACKFILL

2B-1.0 GENERAL

2B-1.1 Scope

1. This section refers to the excavation, maintenance, and backfill for trenches, sewer mains and services, watermains and services, and underground telephone, power, and cable services, and all related appurtenances.

2B-1.2 Related Specifications

1. 1B - General Specifications
2. 2C - Watermains and Appurtenances
3. 2D - Sewermains and Appurtenances
4. 2K - Rock Blasting

2B-2.0 PRODUCTS

2B-2.1 Topsoil

1. Topsoil shall be material containing organics, free of large roots and cobbles (25mm maximum diameter) and which, in the opinion of the Engineer, is suitable for landscaping.

2B-2.2 Blast Rock

1. For payment purposes, blast rock shall include:

    - solid ledge rock formations of homogeneous sedimentary, igneous or metamorphic material which, in the opinion of the Engineer, requires drilling and blasting, or breaking up with power operated hand tools for removal.

    - material which cannot be excavated, ripped, or removed by an Excavator of 38,400 kg (equivalent to 235 Cat) with a single tooth ripper and operated by a qualified operator.

2B-2.3 Rippable Rock and Boulders

1. Rippable trench rock shall include material which can be ripped and excavated with a 38,400 kg Excavator (equivalent to 235 Cat) with a single tooth ripper and operated by a qualified operator.

2. Boulders shall include detached masses of rock with a volume of one cubic metre or greater, and which can be excavated with a 38,400 kg Excavator (equivalent to 235 Cat) with a single tooth ripper and operated by a qualified operator.

2B-2.0 MATERIALS (Cont'd)

2B-2.4 Common Excavation Material

1. Common excavation material shall include material which is not topsoil, blast rock, rippable rock or boulders.

2B-2.5 Waste Material

1. Waste material shall include:

    - common excavation material which is unsuitable for trench backfill due to saturated or otherwise unstable characteristics.

    - broken pavement, organic debris, masonry, rock, frozen material, blast rock, rippable rock, or boulders which, in the opinion of the Engineer, are unsuitable for trench backfill.

2. Waste material shall be disposed in a location designated by the Engineer.

2B-2.6 Imported Backfill

1. Imported backfill shall be pitrun gravel, free from shale, clay, friable materials, organic matter and other deleterious substances.

2. Shall conform to the following gradation limits when tested in accordance with ASTM C136.

U.S. Standard - Sieve Size	Gradation Limits % Passing by Weight
75mm (3 inch)	100%
25mm (1 inch)	50-85%
0.150mm (#100)	0-16%
0.075mm (#200)	0-8% (wet sieving)

2B-2.7 Native Backfill

1. Native backfill shall be common excavation material free of:

- cobbles and angular rock fragments larger than 150mm nominal diameter.

- roots, stumps or other materials which would prevent consolidation and compaction.

2B-2.8 Bedding

1. Bedding shall be in accordance with the Standard Drawings and the following designations.

   Class A - concrete bedding in accordance with the Drawings.

   Class B - imported sand bedding in the trench bottom, compacted in lifts to 95% Standard Proctor Density to a point 300mm above the crown of the pipe as shown on the Standard Drawings. Sand bedding shall be a clean, well graded sand with a maximum aggregate size of 6mm.

   Class C - selected excavated materials to be compacted in 100mm lifts to 95% Standard Proctor Density to a point 300mm above the crown of the pipe, as shown on the Standard Drawings.

2B-2.9 Subbase Gravel

1. Shall be pitrun gravel approved by the Engineer.

2. Free of disintegrated or shattered, and thin and elongated rock pieces. Shall not contain organic material.

3. Shall conform to the following gradation limits when tested in accordance with ASTM C136.

U.S. Standard - Sieve Size	Gradation Limits % Passing by Weight
75mm (3 inch)	100%
25mm (1 inch)	50-85%
0.150mm (#100)	0-16%
0.075mm (#200)	0-8% (wet sieving)

2B-2.10 Base Gravel

1. Shall be crushed gravel approved by the Engineer.

2. Free from wood wastes, roots, organic, and other objectionable material.

2B-2.10 Base Gravel (Cont'd.)

3. Uniformly graded conforming to the following gradation units:

U.S. Standard - Sieve Size	Gradation Limits % Passing by Weight
19mm (3/4 inch)	100%
9.5mm (3/8 inch)	60-100%
4.75mm (#4)	40-80%
2.36mm (#8)	30-60%
1.18mm (#16)	20-45%
.300mm (#50)	8-20%
.975mm (#200)	2-9% (wet sieving)

4. A minimum of 60% of material retained on the 4.75mm sieve shall have at least two fractured faces. The percentage shall be determined by particle count.

2B-3.0 EXECUTION

2B-3.1 Site Preparation

1. Clear surface of roadway or ground within the excavation area and dispose of refuse material as directed by the Engineer.

2. Cut the pavement surface in straight lines parallel to the trench centreline. The cut edge of the pavement shall be a maximum of 50mm outside the top of the excavation.

3. Reusable surface material including topsoil and surface gravels, shall be windrowed away from the excavation area. These materials are to be replaced after the backfilling operation is completed.

2B-3.2 Existing Facilities

1. Prior to excavation, the locations of all structures, pipes, and other existing services are to be determined.

2. All excavation material will be stockpiled in a manner that will minimize the effect on pedestrian and vehicle traffic. No existing development shall be left without temporary access. When instructed by the Engineer, the Contractor shall provide all necessary flagpersons, barricades, signage, and warning lights.

3. All conflicting existing services shall remain in service and shall be protected from damage, at no cost to the owner.

2B-3.2 Existing Facilities (Cont'd.)

4. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, and other utility controls shall be left unobstructed and accessible.

5. Gutters, ditches, and natural watercourses shall not be obstructed.

6. Excavated materials shall not be deposited over legal survey pins.

2B-3.3 Shoring

1. Shoring shall conform to the standards and regulations of the Workers' Compensation Board.

2. Where shoring is required to be left permanently in place on the written order of the Engineer, it will be paid for on a force account basis for materials only.

3. Shoring left in place shall be cut off at least one metre below existing ground elevation or one metre below the finished street elevation.

4. Shoring shall not be removed until backfilling has progressed to a depth of 300mm above the pipe, and shall be removed in such a manner to avoid trench cave-in.

2B-3.4 Dewatering

1. The discharge from pumps, well points, or other dewatering equipment shall be located in such a manner to prevent damage, nuisance, and inconvenience to public and private property.

2. Caution shall be exercised to ensure that foundation problems with existing structures and works under construction do not result from the dewatering operation.

3. Trench water shall not be allowed to enter the pipe being installed unless approval is given by the Engineer.

2B-3.5 Trench Excavation

1. The sidewalls of the trench shall be cut vertically from the trench invert to 300mm above the crown of the pipe, and then sloped to the ground surface. The pitch of the slope shall be in accordance with recognized safety standards.

2. Not less than 150mm or more than 300mm of clearance shall be provided between the side of the pipe and the vertical trench wall.

3. Trench bottoms shall be firm, undisturbed soil and shall be free of all loose and protruding rock. The trench shall be excavated to an adequate depth to allow placement of the specified pipe bedding.

2B-3.5 Trench Excavation (Cont'd.)

4. Excavations deeper than the grades shown on the Design Drawings shall be backfilled with approved materials and compacted to 95% of Standard Proctor Density to the design excavation depth.

2B-3.6 Backfill Within the Pipe Zone

1. The pipe zone shall be defined as the area from the bottom of the trench (including bedding clearances) to a point of 300mm above the top of the pipe, for the full width of the trench excavation. The class of bedding required shall be in accordance with that specified in the Tender Form.

2. After each section of pipe has been installed on the prepared bed, bedding material shall be placed to the springline and hand tamped with an approved tamping bar. Bedding material shall then be placed and tamped to 300mm above the crown of the pipe in lifts of maximum 500mm depth.

3. Machine backfilling shall take place only after the pipe zone has been properly bedded.

4. A continuous pipe laying and bedding operation shall be maintained. No more than two pipe lengths shall be installed without proper bedding material being in place.

2B-3.7 Backfill Above the Pipe Zone

2B-3.7A <u>Placing</u>

1. Backfill material shall be common excavation material or approved imported backfill, and shall be placed in a dry trench.

2. Backfill material shall be compacted to 95% Standard Proctor Density in lifts not exceeding 300mm uncompacted depth. Where additional water is required to obtain the specified density, it shall be applied in such a manner to maintain uniform moisture content.

3. Motorized compaction equipment shall be used with extreme caution to prevent damage to public or private property or to the new pipeline.

4. Where concrete encasement (Class A bedding) is specified, machine backfilling shall not be undertaken until concrete has set for at least 24 hours.

2B-3.7B <u>Classes of Backfill</u>

1. *Class I*

a) Place pit-run gravel or sand in 300mm lifts over the whole width of the trench, each lift compacted to 95% of the maximum density at optimum moisture content as determined by the Standard Proctor Test.

2B-3.7B Classes of Backfill (Cont'd)

b) Compact the top 450mm to 95% of the maximum density at optimum moisture content as determined by the Standard Proctor Test.

c) Remove all surplus excavated material, or stockpile on-site as directed.

d) Where the excavation was carried out on an earth or gravel street, bring the compacted granular material up to the original grade.

e) Where the excavation was carried out on a paved street, bring the compacted granular material up to the elevation of the base course as shown on the Drawing.

2. *Class II*

a) Place native backfill material in 300mm lifts over the width of the trench, each lift compacted using mechanical compaction equipment. Compact with the moisture content such that 95% Standard Proctor Density is obtained.

b) Backfill material shall be free of wood, brush or other perishable, objectionable material. No rocks larger than 200mm shall be included in the material.

c) The Contractor may use imported material in lieu of the native material.

d) Where, in the opinion of the Engineer, the excavated material is unsuitable for backfilling purposes, the Contractor shall, upon written order from the Engineer, use imported material.

e) Where the excavation was carried out on an earth street, bring the compacted material up to the original street level.

f) Where the excavation was carried out on a gravel street, bring the compacted material up to the base of the surface gravel as shown on the Drawings or as specified.

3. *Class III*

a) Class III backfill is machine backfill, with native backfill placed in the trench in layers 1.0 metre thick and compacted by running a tracked machine along the trench as backfilling proceeds.

b) Backfill material shall be free of wood, brush or other perishable, objectionable material. Rocks larger than 200mm may be placed in the backfill.

c) Round the backfill over the trench as directed by the Engineer, to allow for settlement.

d) Remove all surplus excavated material.

2B-3.7C Backfilling Tunnels, Boreholes

1. Backfill all voids with sand placed manually, mechanically or pneumatically.

2B-3.7D Water Flushed Backfill

1. Water jet or flood backfill in 600mm layers if ordered in writing by the Engineer.

2B-3.8 Disposal of Waste and Surplus Material

1. All waste and surplus material shall be disposed of in areas specified in the Contract Documents, or as approved by the Engineer.

2. All waste disposal areas shall be leveled and cleaned to the satisfaction of the Engineer.

2B-3.9 Restoration

1. All street repair work shall be equal to, or better than, the condition of the street before the trench excavation and pipe laying operation. All boulevards, easements, ditches, and work on private and public property shall be restored to original condition, including landscaping, grass and tree planting, gravelling, etc.

2. Road repair shall consist of:

    - base course of subbase gravel, minimum of 200mm thick or equal to the existing base depth, whichever is greater.

    - leveling course of base gravel, minimum of 75mm thick.

    - surface course of asphaltic concrete (hot mix) equal in thickness to the existing pavement or 50mm, whichever is greater.

3. All base materials shall be compacted to 100% Standard Proctor Density. A bonding agent shall be applied to the edges of the existing pavement.

2B-3.10 Inspection and Testing

1. All material supplied shall be approved in writing by the Engineer.

2. Application for the Engineer's approval for sand bedding, crush gravel, drain rock, and pit-run gravel shall include a list of source, Standard Proctor Density determination, and gradation curve for each material type.

3. Frequency and type of density tests shall be at the discretion of the Engineer, to a maximum of one density test per 150 metres trench length per vertical metre of trench depth.

2B-3.10 Inspection and Testing (Cont'd)

4. All materials not meeting the requirements of the specifications shall be removed or reworked to comply with the specifications.

2B-4.0 MEASUREMENT FOR PAYMENT

2B-4.1 General

1. Payment for the following items shall include all field layout and grade sheet preparation, equipment, labor, drainage protection of the work area, borrow pit development, loading, handling, placing, compaction, watering, grading and all other incidental items required for excavation and backfill, to the satisfaction of the Engineer.

2B-4.2 Imported Backfill

1. The volume of imported backfill shall be determined by the average end area method for the length of trench affected.

2. Payment for imported backfill will be made at the Contract Unit Price per cubic metre.

3. Over-excavation of material and replacement with imported backfill will not be included in the measurement for payment.

2B-4.3 Waste Material

1. No payment for removal of unsuitable material will be made.

2B-4.4 Blast Rock

1. The volume of blast rock within utility trenches shall be measured on a per cubic metre basis as determined by the Engineer.

2. Rock Volume = depth of rock x trench width x length of rock excavation

    - depth of rock is measured to 150mm below pipe inverts.
    - length is the actual length of the rock excavation.
    - width shall be 0.75 metre, or the pipe diameter plus 300mm, whichever is greater, unless otherwise specified on Drawings.

3. Payment for blast rock including removal and disposal will be made at the Contract Unit Price per cubic metre.

2B-4.5 Rippable Rock

1. No payment for rippable rock shall be made. Excavation of rippable rock shall be included as common excavated material including removal and disposal and will be included in the pipe price.

2B-4.6 Bedding Material

1. No payment for Class B and Class C bedding will be made. Payment for pipe bedding will be included in the pipe price.

2B-4.7 Surface Restoration

1. No payment for landscaping shall be made. All landscaping restoration, as indicated on the Drawings, shall be included in the pipe price.

2. Payment for restoration of gravel roads shall be made at the Contract Unit Price per square metre, and shall be full compensation for excavation to subgrade, subgrade preparation, and supply and placement of subbase gravel and base gravel, as shown on Contract Drawings.

3. Payment for restoration of paved roads shall be made at the Contract Unit Price per square metre, and shall be full compensation for excavation to subgrade, subgrade preparation, supply and placement of subbase gravel, base gravel and asphaltic concrete, removal and disposal of surplus material, site clean-up, and all other incidentals required to complete the work to the satisfaction of the Engineer and the Contract Drawings.

2B-4.8 Trench Excavation

1. No payment will be made for trench excavation and backfill. Trench excavation and backfill shall be included in the pipe price.

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DIVISION 2 - SITEWORK
SECTION 2D- SEWER MAINS AND APPURTENANCES

2D-1.0 GENERAL

2D-1.1 Scope

1. This section refers to the supply of all necessary materials, labour and equipment necessary for the installation of sanitary sewers and storm sewers, including all appurtenances, as specified herein or as shown on the Contract Drawings.

2D-1.2 Related Specifications

1. 2B - Trench Excavation and Backfill
2. 3A - Cast-in-Place Concrete

2D-2.0 PRODUCTS

2D-2.1 General

1. All materials supplied shall be in accordance with the Contract Drawings and Standard Drawings, and shall be consistent with applicable CSA and ASTM Standards.

2. At the request of the Engineer, an independent testing laboratory shall be engaged to test selected samples of the pipe material to prove compliance with the specifications.

2D-2.2 Sewer Pipe Specifications

1. Polyvinyl Chloride (PVC)

    - conform to ASTM D3034
    - bell and spigot joints with rubber gaskets
    - SDR 35 in accordance with ASTM 2412

2. Corrugated Metal Pipe

    - minimum 1.5 mm gauge
    - galvanized
    - comply with CSPI Specification No. 501

2D-2.2 Sewer Pipe Specifications (Cont'd.)

3. Non-Reinforced Concrete Pipe

   - conform to ASTM C14
   - rubber gasket joints conforming to ASTM C443
   - pipe class as specified

4. Reinforced Concrete Pipe

   - conform to ASTM C76
   - rubber gasket joints conforming to ASTM C443
   - pipe class as specified on the Drawings

5. Sewer Forcemains

   - refer to Section 2C - Pressure Mains and Appurtenances Item 2C-2.2 for pipe specifications.

2D-2.3 Manholes

1. Manhole sections shall be reinforced concrete having a minimum internal diameter of 1050 mm, and conforming to ASTM C478.

2. Manhole lids shall be precast reinforced concrete with a design H20 loading.

3. Manhole frames and covers shall be of cast iron construction and shall have a minimum combined mass of 136 kilograms (300 pounds). The cover shall have four (4) vent holes. The frame and cover shall be matched to provide a non-rocking bearing surface. The frame inside dimension shall be a minimum of 560 mm.

4. Manhole rungs shall be constructed of 19 mm diameter hot dip galvanized steel. Spacings shall conform to the Standard Drawings.

2D-2.4 Concrete

1. Shall conform to Section 3A- Cast-in-Place Concrete, and have a compressive strength of 25 Mpa at 28 days.

2. Cement - sulphate resistant Type 50.

2D-2.5 Cement Mortar

1. Cement mortar for pipe joints and manhole construction shall conform to the following mix:

   1 part Portland Cement
   1-1/2 parts clean, sharp sand
   Water to provide workability

2D-2.6 Bedding

1. Sand conforming to the following limits:

    - Retained on No. 4 Screen Max. 10%
    - Passing 100 Mesh Max. 20%

2D-3.0 EXECUTION

2D-3.1 General

1. All sewer mains and appurtenances shall be installed in strict accordance with the Contract Drawings.

2. The Contractor shall be responsible for all layout and surveying.

3. Any changes in sewer main alignment or grade or appurtenance locations will be made in writing by the Engineer.

2D-3.2 Allowable Tolerances

1. Sewer mains shall be installed in accordance with the Contract Drawings and the Contractor's layout.

2. The centreline of the sewer main shall not be more than 30 mm from the approved design alignment.

3. Vertical tolerances shall not exceed the following for the indicated range of pipe grades.

Allowable Vertical Tolerance	% Pipe Grade
± 3 mm	0.0 - 0.39
± 6 mm	0.40 - 0.99
± 12 mm	1.0 - 4.99
± 20 mm	5.0 and up

4. Maximum acceptable ponding over a length not exceeding 5.0 m is 10.0 mm

5. Any pipe sections which contain noticeable ponding below 10 mm in depth will be confirmed by CCTV inspection at the expiry of the maintenance period at the discretion and cost of the Owner. Any ponding greater than 10 mm or other deficiencies discovered by the Owner at that time shall be corrected by the Contractor at no cost to the Owner.

2D-3.3 Pipe Laying and Jointing

1. Prepare pipe bedding in accordance with the Drawings and Bedding Specification 2B-2.8.

2. Bell or coupling ends shall be in the direction of the laying operation.

3. Pipes shall be jointed by the following methods:

    - pushing pipe sections together by hand
    - prying with a steel bar
    - pulling together with a come-along.

4. Pipe shall be laid to grade with laser equipment or a string-line, and an engineering quality level and rod if the grade is 2% or less.

    Batterboards may be used for laying pipe with grades greater than 2%, provided the following conditions apply:

    - at least four (4) consecutive batterboards shall be erected at all times.
    - the distance between adjacent batterboards shall not exceed 15 metres.
    - batterboards shall be painted in alternating bands of contrasting colours.

5. PVC pipe laid at grades of less than 1% shall be laid in lengths not exceeding 4.0 metres.

6. The inside of pipes shall be kept free of dirt, water, and other foreign material. Open ends shall be plugged to keep foreign materials out.

7. Individual pipe joint deflections shall not exceed the maximum deflection angle as published by the pipe manufacturer.

8. Where pipe line alignment is straight between manholes, sighting between manholes through the sewer main must be possible.

9. All pipe cuts shall be at right angles. Edges shall be trimmed and deburred with proper tools to ensure proper jointing.

2D-3.4 Manholes

1. Manholes shall be constructed in accordance with the Contract Drawings, Contract Documents, and Standard Drawings.

2. Manhole bases shall be cast-in-place concrete on a minimum depth of compacted pitrun of 200 mm, in accordance with the Standard Drawings.

3. Manhole barrels shall be accurately set to the vertical.

4. Manhole barrels shall be made watertight by mortaring both the interior and exterior of all joints with a waterproof, non-shrink grout and with an approved butal mastic joint material installed between precast sections.

2D-3.4 Manholes (cont'd)

5. Manhole rims shall be accurately set to match the existing ground elevation, or tilted to match the crown and grade of the road, whichever is applicable, by using grade ring rims. All grade rings shall be mortared to produce an even, neat finish. The maximum spacing between the top of the manhole rim and the first ladder rung shall be 760 mm.

6. Flow channels shall be formed and finished smooth with a steel trowel.

7. Cast in place manhole bases are not to be used unless approved in writing by the Engineer.

8. Pipe stubs shall terminate one metre from the manhole and shall be plugged with a removable, watertight cap. The flow channel and benching within the manhole shall be completed for the stub.

2D-3.5 Sewer Forcemains

1. Sewer forcemains shall be constructed in accordance with Section 2C-3.0 - Pressure Mains and Appurtenances.

2D-3.6 Sewer Services

1. Services shall be installed at locations shown on the Contract Drawings.

2. Minimum service grades are:

Pipe Diameter (in mm)	Minimum Grades (%)
100	2.0%
150	1.0%
200	0.5%
250	0.4%

3. The Contractor shall ensure that all services are inspected and the as-built information is obtained by the Engineer prior to backfilling.

4. Tapping of services into sewer mains shall be undertaken with tools approved by the pipe manufacturer.

5. Service risers shall be installed to a maximum slope of 60% and shall be adequately supported and protected from damage and breakage. Risers shall be backfilled immediately following installation. Backfill compaction to be 95% Standard Proctor Density.

2D-3.6 Sewer Services (cont'd)

6. Services shall be terminated with a watertight cap that is blocked to prevent movement during testing. A 40 mm x 90 mm marker shall be placed behind the service cap. The bottom, which shall be set at the service invert, shall have the depth to invert clearly marked on the stake at least 600 mm above the existing ground elevation. Marking and setting of service terminus stakes shall be done conscientiously and accurately by the Contractor, as the stakes will be used for as-built information. The tops of service marker stakes shall be marked as follows:

    - fluorescent red paint for a sanitary service.
    - fluorescent green paint for a storm service.

2D-3.7 Connection to Existing Systems

1. The Contractor shall undertake the connection to existing systems with minimum disruption to traffic or to the operation of the existing sewer system.

2. Where all connections to the existing systems are to be made by the local Public Works Department, the Contractor shall arrange for and schedule the tie-in operation at no extra cost to the Owner.

2D-3.8 Inspection and Testing

1. The Contractor shall furnish all labour, materials, and equipment to carry out the tests. Testing shall be undertaken in the presence of the Engineer, and shall be to the satisfaction of the Engineer.

2. Testing shall be commenced only after backfilling of all deep services.

3. Cost incurred to witnessing unsuccessful tests by the Engineer shall be borne by the Contractor.

2D-3.9 Testing Gravity Mains

1. Infiltration tests shall be conducted on all gravity mains installed where the groundwater is above the crown of the pipe. In all other cases, exfiltration tests shall be undertaken.

2. Should the test procedures outlined in this specification vary with those of the local approving authority, the more stringent of the two shall govern.

3. The maximum allowable infiltration or exfiltration rate for water shall be 9.30 litres per millimetre of pipe diameter per day per kilometre of pipe.

2D-3.9 Testing Gravity Mains (cont'd)

4. When testing for exfiltration, the minimum net head on the section of sewer being tested shall be the height of the lowest manhole lateral connection, provided the maximum net head on the line does not exceed 8.0 m. Net head is defined as test elevation minus groundwater elevation. The test section of sewer main, preferably between manholes, shall be filled with water as specified herein. The Contractor shall fill the pipeline in such a manner to ensure displacement of air from the line. The test section of sewer is to stand completely full of water and under a slight head for 24 hours before test measurements are commenced to ensure that absorption in the pipe wall is complete. The pipeline shall be accepted if infiltration test requirements are met by one or more tests made during the 24 hour absorption period. The duration of tests shall be one hour.

   An allowance of 3 litres per hour per metre of head above the invert shall be made for each manhole included in the test section. If a test produces more than the allowable leakage, the Contractor shall test manholes separately.

5. As an alternative to the exfiltration test, sewer mains and services may be tested with air.

   Open ends shall be plugged so as to be airtight. Air shall be slowly supplied until the air pressure reaches 20.7 kPa (3 psi). At least two minutes shall be allowed for pressure stabilization before proceeding. The time in minutes for the pressure to drop from 20.7 kPa (3 psi) to 17.2 kPa (2.5 psi) shall not be less than the following:

Pipe Size	Minimum Time
100 mm	152 seconds
150 mm	230 seconds
200 mm	306 seconds
250 mm	382 seconds
300 mm	459 seconds
350 mm	536 seconds
375 mm	570 seconds

   For pipe sizes over 375 mm, the time in seconds for the pressure drop shall not be less than 1.536 times the pipe diameter in millimetres.

2D-3.10 Cleaning and Flushing

1. The Contractor shall provide all necessary labour, materials, and equipment necessary to undertake the cleaning and flushing.

2D-3.10 Cleaning and Flushing (cont'd)

2. All sewer mains, manholes, services, and other appurtenances shall be flushed in the presence of the Engineer to remove all foreign material. The Contractor shall provide a temporary screen at the manhole outlet stub to collect all large objects. The Contractor shall ensure that all large objects that could plug downstream sewers are removed prior to discharging the water into the existing sewer system.

3. When requested by the Engineer, the Contractor shall clean the sewer mains with a test ball not more than 13 mm (1/2 inch) smaller in diameter than the pipe to be cleaned.

2D-3.11 CCTV Inspection

1. Contractor shall flush and clean pipeline immediately prior to CCTV inspection survey. No foreign material shall be present and if deemed unacceptable to the Owner or Engineer, flushing and re-video will be required at no additional cost to the Owner.

2. CCTV inspection is required for all new 150mm and larger diameter gravity sanitary sewer mains. Camera equipment shall be equipped with a measuring device to identify ponding depths within the constructed sanitary sewer mains.

3. Hemispherical head or fisheye lens type cameras are not permitted. The camera is to be capable of producing high quality colour imagery and provide complete inspections and view of all laterals and deficiencies. The camera is to have capability of panning the pipe at 360 degrees with tilt capability of 275 degrees.

4. Eliminate steaming and fogging encountered during the inspection survey by introducing forced air flow by means of a fan.

5. The camera lens is to remain free of grease or other deleterious matter to ensure optimal clarity.

6. Record all digital videos on DVD or Blue Ray compatible with the Owner's devices and submit for review and acceptance to the Owner along with a written hard copy report of video inspection.

7. Set zero chainage at face of every manhole or on entrance into pipe.

8. Report and record on full length of pipe line from inside face to inside face between manhole or outlet end of pipes and from one end of pipe to the other. Note condition of all pipe joints, at manhole walls at the beginning and end of each pipeline.

9. Stop camera at each defect, change of condition of pipe and service connection to record defect in accordance with WRc codes. Add WRc code overlay to digital video at defects or connections in addition to continuously displayed data.

2D-3.11 CCTV Inspection (cont'd)

10. Data generator to electronically generate and clearly display on the video recording a record of data in alpha-numeric form containing the following minimum information:

    - Manhole (from-to)/pipe length reference numbers,
    - Pipeline dimensions,
    - Pipe material,
    - Type or use of pipe,
    - Date of survey,
    - Road name or location,
    - Direction of travel of survey equipment, and
    - Inspection (report) number

2D-3.12 Testing Forcemains

1. Sewer forcemains shall be flushed and tested in accordance with Item 2C-3.10 Pressure Main Flushing and Testing.

2D-4.0 MEASUREMENT FOR PAYMENT

2D-4.1 General

1. Measurements for payment for the following items shall include all field layout and grade monitoring, excavation, frost removal, installation, Class C bedding, tamping, dewatering, backfill, testing, flushing, cleaning, compaction, shoring, final grading, clean-up, and all labour, equipment and materials necessary to complete the work in accordance with the Contract Documents and Drawings.

2D-4.2 Gravity Sewer Mains

1. Length of sewer main shall be the horizontal measurement from centre of manholes along the centreline of the main. The payment quantities for the various depth ranges shall be determined by averaging the differences between the original ground elevation and the sewer invert elevation at coinciding 15 metre stations between two consecutive manholes, including the depths of the manholes.

2. For sewer mains installed in areas excavated to subgrade, the subgrade elevation will be considered to be the original ground elevation.

3. Payment for sewer mains shall be made at the Contract Unit Price per metre for the various depth ranges.

4. Payment for untested mains will only be made on 80% of the length installed.

2D-4.3 Manholes

1. Depth of manholes shall be measured from the underside of the concrete donut to the lowest invert elevation in the manhole.

2. Payment of precast manhole sections shall be made at the Contract Unit Price per vertical metre.

3. Payment for manhole bases, concrete lids, frames and covers shall be made at the Contract Unit Prices as noted on the Schedule of Quantities.

2D-4.4 Exterior Drop Structures

1. Exterior drops for manholes shall be measured from the lowest invert elevation of the drop to the highest invert of the dropped main in the manhole.

2. Payment for exterior and interior drop structures shall be made at the Contract Unit Price.

2D-4.5 Services

1. Length of sewer services shall be the horizontal measurement from the centre of the main to the terminus of the service at the property line. The payment quantities for various depth ranges of cut shall be determined by averaging the differences between the original ground elevation and the service elevation at the property line and at the service riser, or invert of the service connection at the main if no riser has been installed.

2. For services installed in areas to be excavated to subgrade, the subgrade elevation will be considered to be the original ground elevation.

3. Payment for sewer services shall be made at the Contract Unit Price per metre, and shall be full compensation for mainline connection, plugs, service risers and marker posts.

DIVISION 2 - SITEWORK
SECTION 2E - SUBGRADE PREPARATION, GRANULAR SUBBASE, BASE MATERIAL AND ADJUSTMENT OF APPURTENANCES
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DIVISION 2 - SITEWORK
SECTION 2E - SUBGRADE PREPARATION, GRANULAR SUBBASE, BASE MATERIAL AND ADJUSTMENT OF APPURTENANCES

2E-1.0 GENERAL

2E-1.1 Scope

1. This section governs the subgrade preparation and the supply, placement and compaction of Granular Subbase and Base Courses.

2E-1.2 Related Specifications

1. 2A - Earthwork
2. 2B - Trench Excavation and Backfill
3. 2G - Asphaltic Concrete
4. 2F - Curb, Gutter and Sidewalk

2E-2.0 MATERIAL SPECIFICATIONS AND DEFINITIONS

2E-2.1 Subgrade Preparation

1. Subgrade Preparation shall include all works required to prepare the Subgrade for the Granular Base Courses after earthwork and/or utilities have been installed.

2E-2.2 Subbase

1. Shall be pitrun gravel approved by the Engineer.

2. Free of disintegrated or shattered, and thin and elongated rock pieces. Shall not contain organic material.

3. Shall conform to the following gradation limits when tested in accordance with ASTM C136.

US Standard Sieve Size	**Gradation Limits Percent Passing by Weight**
75 mm	100%
25 mm	50 - 85%
150 um	0 - 16%
75 um	0 - 8% (washed wet sieving)

2E-2.3 Base Course

1. Shall be crushed gravel approved by the Engineer.

2. Free from wood wastes, roots, organic, and other objectionable material.

3. Uniformly graded conforming to the following gradation units.

US Standard Sieve Size	Percent Passing by Weight
19 mm	100%
9.5 mm	50 - 100%
4.75 mm	40 - 80%
2.36 mm	30 - 60%
1.18 mm	20 - 45%
300 um	8 - 20%
75 um	2 - 9% (washed wet sieving)

4. A minimum of 60% of material retained on the 4.75 mm sieve shall have at least two fractured faces. The percentage shall be determined by particle count.

2E-3.0 CONSTRUCTION

2E-3.1 Subgrade Preparation

1. Should the earthwork be done by others, centerline road profiles will be run by the Engineer to ensure that the subgrade left by the earthwork contractor is within allowable tolerance of ± 25 mm stipulated in Section 2A Earthworks. This information shall be made available to the Contractor if requested.

2. The subgrade shall be graded and shaped to within 15 mm of the approved stakes, crown, and grade shown on the Contract Drawings.

3. The Contractor shall maintain and protect the subgrade and be responsible at no cost to the Owner for its protection from vehicular traffic, rain or other damaging causes throughout the term of the contract. Damaged subgrades shall be scarified to a depth of 300 mm and reshaped and compacted to 100% Standard Proctor Density at no cost to the Owner.

4. Any soft spots and deleterious material shall be removed and backfilled with pitrun gravel and compacted to 100% Standard Proctor Density. No payment will be made for this work if the Contractor fails to identify these areas to the Engineer prior to the installation of utilities.

2E-3.1 Subgrade Preparation (cont'd)

5. After installation of all utilities and prior to placement of subbase and base course gravels, the upper 150 mm and total width of subgrade shall be scarified and compacted to 100% Standard Proctor Density over the entire subgrade area, and proof-rolled in the presence of the Engineer with a piece of equipment approved by the Engineer. Soft spots shall be rectified as specified in Item 4 above.

2E-3.2 Adjustments to Utilities and Appurtenances

1. The Contractor shall ensure that no damage is done to the existing utilities or appurtenances. In the event that the Contractor deems it necessary to adjust the locations of a utility and/or its related appurtenances in order to protect it, he shall conduct the necessary relocations and after completion of the works, restore it to its original location and elevation at no cost to the Owner.

2. Appurtenances such as manholes, valve boxes, catch basins, etc., shall be adjusted by the Contractor to match finished grade and crown of the road.

3. On roads to be paved immediately after base operation has been completed, the appurtenances shall be adjusted to 10 mm below the paved surface.

4. The Contractor shall adjust appurtenances such as manhole frames, catch basin frames, etc., by adding or removing bricks or spacer rings.

5. Bricks or spacer rings added in order to adjust appurtenances shall be mortared into place. In either case, frames shall be mortared to the last row of bricks.

6. Valve boxes or other similar appurtenances shall be adjusted by sliding the valve box cover up or down to match the appropriate road grade elevation.

7. The top of the valve box risers shall be situated between 50 mm below the top of the valve box and 50 mm above the bottom of the valve box, as shown on the Standard Drawings.

2E -3.3Subbase

1. After the subgrade has been approved by the Engineer, pitrun gravel shall be placed in 150 mm lifts to the depths and lines shown on the Contract Drawings and compacted to 100% Standard Proctor Density.

2E-3.4 Base Course

1. After the subbase has been approved by the Engineer, crushed gravel shall be placed to the depth and lines shown on the Contract Drawings and compacted to 100% Standard Proctor Density.

2E-3.5 Compaction of Subbase and Base Course

1. The granular subbase and base course material shall be compacted by rolling with a pneumatic tired roller, vibratory roller, or other approved type. Each layer shall be compacted at the optimum moisture content, to 100 percent of the maximum dry density as determined by the Standard Proctor compaction test for the material used.

2. During compaction, water shall be added by an applicator in such quantities that the moisture content will be maintained at the optimum level as determined by the Standard Proctor test. If the moisture content exceeds the optimum moisture content, the material shall be aerated by mechanical means or work shall cease temporarily until the material has dried sufficiently to reach the optimum moisture content.

2E-3.6 Shaping of Subbase and Base Course

1. A blade grader shall be used in conjunction with the compaction equipment to keep the finished surface of each layer even and uniform. The finished surfaces of the granular base course and subbase course shall conform to the required cross-section and grades as shown on the Drawings and as staked by the Engineer, within a tolerance of plus or minus 15 mm. The finished subbase course surface shall show no depression more than 13 mm under a straight edge of 3 m long placed parallel to the road centerline. The finished base course surface shall show no depression more than 6 mm under a straight edge 3 m long placed parallel to the road centerline.

2E-3.7 Proof-Rolling of Subgrade, Subbase and Base Course

1. If ordered by the Engineer, the Contractor shall supply and operate a loaded test vehicle of 8200 kg axle load to test the subgrade, subbase and base course for rutting and weaving.

2E-4.0 TESTING

1. A Standard Proctor Density may be required on each type of material encountered. The frequency and type of compaction tests shall be at the discretion of the Engineer. Approximate testing frequency may be in the following range:

   (a) Subgrade - one test per 500 square metres of subgrade.

   (b) Soft Spot Repair - one test per 300 mm of backfill (to maximum of 100 square metres, then embankment requirements apply).

   (c) Pitrun and Crushed Gravel - one test per 500 square metres.

2E-5.0 MEASUREMENT AND PAYMENT

1. Unless otherwise specified in the Contract Documents, measurement of subgrade preparation, subbase and base course materials will be done by the tonne or by the horizontal area expressed in square metres to the nearest square metre of in-place material of a specified thickness, as calculated from the Contract Drawings.

2. Payment shall include all field layout, grade sheet preparation, equipment, labour, drainage protection of the work area, materials, royalties, pit development, proof-rolling, clean-up and all other incidental items to complete the work in accordance with the Contract Documents and Drawings.

2E-5.1 Subgrade Preparation

1. Measurement of the subgrade preparation shall be the horizontal area in square metres required under the pitrun and calculated from the Contract Drawings.

2. Payment for subgrade preparation shall be made at the Contract Unit Price per square metre or as otherwise noted on the Schedule of Quantities.

2E-5.2 Subbase

1. Unless otherwise specified in the Contract Documents, measurement of pitrun subbase material will be by the horizontal area expressed in square metres of in-place material of a specified thickness, calculated from the Contract Drawings.

2. Payment for subbase preparation shall be made at the Contract Unit Price per square metre or as otherwise noted on the Schedule of Quantities.

2E-5.3 Base Course

1. Unless otherwise specified in the Contract Documents, measurement of pitrun subbase material will be by the horizontal area expressed in square metres of in-place material of a specified thickness, calculated from the Contract Drawings.

2. Payment for the base course preparation shall be made at the Contract Unit Price per square metre or as otherwise noted on the Schedule of Quantities.

2E-5.4 Appurtenance Adjustment

1. Measurement of appurtenance adjustments will only be made when the utilities and appurtenances are existing or have been installed by another General Contractor.

2. Payment for appurtenance adjustment shall be made at the Contract Unit Price for each item adjusted and shall include supply and installation of all materials to complete the adjustment. There shall be no additional payment for temporarily lowering appurtenances or for locating or protecting of these appurtenances.

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DIVISION 2 - SITEWORK
SECTION 2F - CURB, GUTTER AND SIDEWALK

2F-1.0 GENERAL

2F-1.1 Scope

1. This section governs the subgrade and subbase preparation and the construction of extruded and formed concrete curbs, gutters and sidewalks.

2F-1.2 Related Specifications

1. 2A - Earthwork
2. 2E- Subgrade Preparation, Granular Subbase, Base Material and Adjustment of Appurtenances

2F-2.0 MATERIALS

2F-2.1 General

1. All materials supplied shall conform to the applicable ASTM and CSA Standards.

2F-2.2 Concrete

1. The materials for concrete shall meet CSA A23.1-94, Exposure Class C-2, complying with the following specifications.

a) Compressive Strength	32 Mpa at 28 days
b) Slump	50 mm ± 20 mm
c) Maximum Size Aggregate	28 mm
d) Air Entrainment	4% to 7%
e) Cement shall be Type I Normal or Type III High Early Strength if required.	
f) Extruded Concrete Curb shall have a Slum of 0 mm	
g) Water/cementing material ratio	0.45

2F-2.3 Reinforcing

1. Where reinforcing steel or wire mesh is required, this material shall be as specified in the Contract Documents.

2F-2.4 Expansion Joints

1. Materials used for expansion joints shall conform to ASTM D-545.

2F-2.5 Curing Compound

1. Curing compound conforming to CGSB 90-GP-1-A, and approved by the Engineer.

2F-2.6 Sealing Solution

1. An approved concrete sealant is required on all exposed curb, gutter and sidewalk surfaces. This sealant must meet all applicable CSA/CAN 3 standards.

2F-3.0 CONSTRUCTION

2F-3.1 General

1. Obtain approval of the Engineer before placing any concrete.

2. All curb, gutter and sidewalks shall be constructed in strict accordance with the Drawings.

3. Prior to undertaking any grading or setting of forms, the Contractor shall submit grade sheets to the Engineer for approval.

4. Any changes in alignment or grade shall be authorized in writing by the Engineer.

2F-3.2 Allowable Tolerances

1. Horizontal and vertical alignment tolerances shall not exceed the following:

Horizontal alignment ± 5 mm in any 3 m section
Vertical alignment (any point) ± 3 mm

2F -3.3 Subgrade, Subbase and Base Preparation

1. Excavations and embankments required to establish the design grade of a section of curb, gutter or sidewalk shall be undertaken in accordance with Section 2A of these Contract Documents.

2. Where applicable, the Contractor shall prepare the subgrade and supply and place the subbase in accordance with the Drawings and Section 2E of these Contract Documents.

3. The Contractor shall supply and place the base in accordance with the Drawings and Section 2E of these Contract Documents.

4. The graded, compacted surface of the subbase shall not vary more than 10 mm from design grade.

2F-3.4 Concrete Placing

1. Prior to placing of concrete, the Contractor shall water down all ground surfaces over which concrete is to be poured.

2. All existing concrete surfaces shall be painted with a concrete adhesive (as recommended by the manufacturer) prior to concrete pours
.
3. The Contractor shall maintain men and equipment to efficiently handle the volume of concrete to be poured.

4. Pouring operations shall be maintained continuously.

5. Concrete being vibrated into place should be screened immediately after placing.

2F-3.5 Concrete Placement Cold Weather Requirements

1. Do not place concrete when air temperature is below 4°C, unless the following requirements are met.

2. Preheat water and aggregates as well as reinforcement, forms and the ground.

3. When temperature in the shade is 2°C and indications are that the temperature will fall, cover the concrete and maintain an adequate air cushion between the concrete and the cover. Maintain temperature of the air cushion at 10°C, and if forced air heating is used, add moisture. Keep the air cushion heated for 72 hours and keep the protection for 96 hours.

4. Do not use calcium chloride, except with the written permission of the Engineer, and then only with normal Portland cement and in quantities less than 2% by weight. Close control of calcium chloride quantities and careful mixing is required.

2F-3.6 Expansion Joints

1. Expansion joints shall be installed at the beginning and end of every return.

2. Expansion joints 10 mm min. thick shall be installed through the entire width and depth of the curb, gutter and sidewalk section.

3. A 6 mm rounded edge shall be run along each side of the joint.

4. The end of each day’s pour shall be terminated with an expansion joint.

2F-3.7 Contraction Joints

1. Contraction joints shall be constructed every 3 metres by means of an approved marking tool which has a minimum width of 32 mm and a minimum depth of one quarter of the depth of the concrete section at the point of cut.

2. The edges of the tool shall be rounded off with a 6 mm radius corner.

3. Contraction joints shall be the full width of, and perpendicular to, the longitudinal axis of the curb, gutter or sidewalk section.

2F-3.8 Finishes

1. The Contractor shall, when the concrete has partially set up, work the surface of the concrete with wood and steel trowels to a smooth, uniform surface.

2. Under no circumstances shall the Contractor sprinkle water onto the surface of the concrete in order to provide a more workable surface.

3. After steel trowelling the surface to a smooth, even finish, the Contractor shall broom the sidewalk transversely.

4. Curbs and gutters shall be steel trowelled to a smooth, even finish.

5. No mortar coat or water shall be used. After brooming the sidewalk, all edges shall be rounded with an approved edge which has a minimum width of 32 mm and a minimum depth of 13 mm.

2F-3.9 Driveway and Lane Crossings

1. The Contractor shall be responsible for the correct location and installation of all driveway and lane crossings.

2. Crossings shall be constructed according to the Drawings.

2F-3.10 Protection

1. During the construction of curbs, gutters and sidewalks, the Contractor shall undertake the necessary preventative measures to protect his forms, machinery, tools and freshly poured and finished concrete from damage caused by vandalism, traffic, hot or cold weather and other adverse effects.

2. All damage to the curbs, gutters and sidewalks shall be repaired by the Contractor at no additional cost to the Owner.

3. Construction equipment shall not be worked adjacent to the curb, gutter or sidewalk until the concrete has attained adequate strength. This shall be for at least 7 days, or as directed by the Engineer.

2F-3.11 Curing

1. Apply curing compound as soon as possible after forms are removed.

2. Apply curing compound uniformly with an approved pressurized spray.

2F-3.12 Sealing

1. Concrete surfaces must be clean and dry.

2. Make the first application of sealing compound between 3 to 7 days after the time that the concrete is poured.

3. Apply the second coat immediately after the first coat has been absorbed and appears dry.

4. Coverage
   - First coat 8.6 sq.m per litre.
   - Second coat 12 sq.m per litre

5. Apply uniformly with an approved pressurized spray.

2F-4.0 TESTING

2F-4.1 General

1. Tests will be performed by the testing laboratory engaged by the Owner. The type and frequency of tests will be on a random basis and may include as many tests as follows:

Slump Tests	1 test per truckload
Air Entrainment	1 test per 150 lineal metres
Compressive Strength (3 cylinders)	1 test per 150 lineal metres

2F-4.2 Strength Deficiencies

1. Where the average 28 day compressive strength of a test is less than 30 MPa but exceeds 25 MPa, the unit price for the work, if approved by the local approving authority, will be reduced by an amount equal to the tendered unit price multiplied by the amount the average test strength is below 30 MPa and divided by 30 MPa.

2. Where the average 28 day compressive strength of a test is less than 25 MPa, the work shall be removed and replaced at the Contractor’s expense.

2F-4.3 Cosmetic Deficiencies

1. Sections of curbs, gutters and sidewalks that do not conform to the allowable tolerances for horizontal and vertical alignment, surface blemishes or other defects shall be removed and replaced at the Contractor's expense.

2. All replaced work shall be subject to the requirements and conditions of the Contract.

2F-5.0 ROAD AND LANDSCAPING REPAIR

2F-5.1 General

1. All areas that have been damaged due to the construction of the curb, gutter and sidewalk shall be repaired to the satisfaction of the Engineer, Municipal Approving Authority and Property Owner (where the work affects private property).

2. Driveways shall be either built up or cut down whether within private property with the Owner's permission, or on road rights-of-way in order to facilitate reasonable permanent access to the property. Driveways shall be resurfaced to the original condition that the driveway was prior to the start of the construction.

3. Boulevards, private lawns, and all landscaping shall be filled, cut down, and re-landscaped to match the elevation of the sidewalk, curb, or median section. These areas must be re-landscaped with a minimum of 50 mm of topsoil and seeded with an approved lawn grass. The Contractor shall leave an area in as close to its original condition as possible.

4. All shrubs, trees, and rock gardens shall be preserved by the Contractor. In the event of damage due to construction operations, these shall be replaced at no extra cost to the Owner.

5. Existing streets shall be repaired with a minimum of 200 mm pitrun gravel, 75 mm of 19 mm crush and 50 mm of asphalt. Streets shall be swept, cleaned up, and washed after completion of all concrete work, landscaping, and clean up. Refuse material shall be removed and disposed of in sites approved by the Engineer.

2F-6.0 MEASUREMENT AND PAYMENT

1. Measurement will be on a lineal metre or square metre basis and shall correspond to the actual length or area installed and accepted.

2. Payment shall include all field layout and cut sheet preparation, equipment, labour, drainage protection of the work area, frost removal, materials, forms, backfilling, weather protection, landscaping, grass seeding, street repair, driveway adjustments and, where applicable, excavation, embankment, subgrade preparation and subbase, and all other work necessary to complete the work in accordance with these Contract Documents.

2F-6.1 Curb, Gutter and Sidewalks

1. Measurement shall be based on the following:

    a) Monolithic curb, gutter and sidewalk shall be measured along the face of the curb to the nearest 100 mm.

    b) Curb and gutter shall be measured along the face of the curb to the nearest 100 mm.

    c) Separate sidewalks shall be measured along the centreline of the sidewalk by the specified width to the nearest 0.1 square metre.

    d) Concrete driveway crossings shall be measured along the centreline of the crossing between contraction joints by the specified width to the nearest 0.1 square metre.

    e) Concrete swales shall be measured along the centreline to the nearest 100 mm.

2. Payment shall be made in accordance with the Contract Unit Price per item as outlined in the Schedule of Quantities and shall also be full compensation for the supply and placement of the crushed gravel based from the face of gutter to back of curb and to the full width of sidewalks and driveway crossings as shown on the Drawings.

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DIVISION 2 - SITEWORK
SECTION 2G - ASPHALTIC CONCRETE

2G-1.0 GENERAL

2G-1.1 Scope

1. This section governs the supply and placement of asphaltic concrete and related bituminous road surface materials.

2G-1.2 Related Specifications

1. 2B - Trench Excavation and Backfill
2. 2F- Curb, Gutter and Sidewalk
3. 2E - Subgrade Preparation, Granular Subbase, Base Material and Adjustment of Appurtenances

2G-2.0 MATERIALS

2G-2.1 General

1. All materials supplied shall conform to these specifications and the applicable ASTM Standards.

2. All work will be performed in a manner that will cause the least disruption to traffic. The Contractor, if required, will be responsible for detours, flagmen and traffic signs.

3. Plant Inspection, On-Site Testing and Inspection, and Laboratory Testing will be carried out by the Engineer as deemed necessary. The Contractor will be expected to carry out his own quality control as required for proper performance of his plant and field operations.

2G-2.2 Asphalt Cement

1. Asphalt cement, prepared by the refining of petroleum, shall conform to ASTM D946, penetration grade: 85-100.

2. Asphalt cement shall be of uniform character, free of water, and shall not foam when heated to 177°C.

3. The maximum variation of the asphalt cement shall not exceed 0.25 percent from the design by weight in the total mixture.

2G-2.3 Mineral Aggregate

1. All crushed aggregate supplied by the Contractor and to be used for asphaltic concrete shall be clean, tough, durable, moderately sharp and free from coatings of clay, silt, loam or other deleterious materials.

2. Coarse aggregate shall be all material retained on a 4.75 mm sieve. This aggregate shall consist of hard, clean, durable, crushed stone, crushed slag, crushed gravel, or a combination thereof, or of material naturally occurring in a fractured condition.

3. Coarse aggregates shall conform to the soundness, abrasive and grading requirements of ASTM C88, ASTM C131, and ASTM D692-71.

4. Of the material retained on a 4.75 mm screen, at least 60% by weight shall have one or more crushed faces.

5. Fine aggregate shall be all material passing through a 4.75 mm sieve. This aggregate shall consist of natural sand and/or manufactured material derived from crushing stone, slag or gravel.

6. Fine aggregates shall conform to the soundness, abrasive, and grading requirements of ASTM C88, ASTM C131, and ASTM D1073-63.

7. The materials of which asphaltic hot-mix is composed shall be of such sizes and gradation that, when proportioned and mixed together, they will produce an intimate and uniform mixture conforming to the requirements as shown in the following table:

Sieve Size	**Percent of Combined Aggregate Passing Washed Sieve Analysis**		
	19 mm Minus (Normal)	**12.5 mm Minus (Intermediate)**	9.5 **mm Minus (Fine)**
19 mm	100%		
12.5 mm	80 - 100	100%	
9.5 mm	70 - 90	80 - 100	100%
4.75 mm	50 - 70	45 - 80	80 - 100
2.36 mm	35 - 50	32 - 64	67 - 94
600 um	18 - 30	17 - 40	40 - 78
300 um	12 - 20	13 - 29	22 - 57
150 um	7 - 15	7 - 18	8 - 35
75 um	4 - 8	4 - 12	5 - 14

8. The method of sieve or screen analysis of fine and coarse aggregates shall be in accordance with the ASTM C136-76.

2G-2.3 Mineral Aggregate (cont'd)

9. The maximum permission variation from the design gradation shall be as follows: (percent by weight passing)

Sieve Sizes		Variation
(1)	19 mm, 12.5 mm, 9.5 mm	± 4%
(2)	4.75 mm to 600 um	± 3%
(3)	300 um to 150 um	± 2.5%
(4)	75 um	± 1.5%

10. The soundness of coarse aggregates as determined by ASTM C88 shall have a maximum loss after 5 cycles not exceeding 12% with sodium sulfate or 18% with magnesium sulfate.

11. The soundness of fine aggregates as determined by ASTM C88 shall have a maximum loss of 5 cycles not exceeding 15% using sodium sulfate and 20% using magnesium sulfate.

12. The maximum absorption of the coarse aggregate when tested in accordance with the ASTM C127 shall be 1.7 percent.

13. Aggregate having known polishing characteristics shall not be used in surface coarse mixes except by express permission of the Engineer.

2G-2.4 Mineral Filler

1. Mineral filler shall consist of all mineral matter which will pass the 75 um sieve.

2. Mineral filler may consist of fine particles of the coarse or fine aggregate or finely ground particles of limestone, hydrated lime, Portland cement or other selected mineral matter. It shall be dry and free from organic matter, clay particles or lumps.

3. Mineral fill shall be non-plastic when tested in accordance with ASTM D242-70.

2G-2.5 Prime Coat

1. Prime coat to be used only when specified.

2. Prime coats shall be M.C 30, or as approved, applied to the surface at a rate of 1.35 to 2.20 litres per square metre by means of an approved distributor.

2G-2.6 Tack Coats

1. Tack coats shall be RC-30, or as approved, applied to the surface or where required at a rate of 0.25 to 0.80 litres per square metre by an approved distributor.

2G-3.0 DESIGN CRITERIA

1. The Asphaltic Concrete mix design shall meet the specifications of the local approving authority. When applicable, the Contractor shall submit his design to the local approving authority for approval. A copy of the written approval shall be submitted to the Engineer prior to commencement of any paving.

2. In areas where the local approving authority does not have a specified design, the following specifications shall apply:

Characteristic	
Asphalt cement viscosity grade	AC6
Asphalt cement content (by total wt. of mix)	4.5% - 7.0%
Compaction blows per end of specimen	75
Marshall Stability @ 68°C	545 kg
Flow Index (units of 0.25 mm)	8 - 16
% voids in total mix (compacted)	3 - 5
% V.M.A.	14 (min.)
Mixing temperature	143°C - 157°C
Asphalt cement temperature	135°C - 148°C
Aggregate temperature	140°C - 162°C

3. The Contractor shall submit duplicate copies of a design mix as recommended by a testing agency employed by the Contractor. The design mix shall satisfy the specified criteria based on the Standard Marshall Test Procedure ASTM D1559-76.

4. The mix design and job mix formula shall be submitted to the Engineer for approval at least 7 days before commencement of the mixing operations. Paving work will not be allowed to proceed until the Engineer has agreed in writing that the submitted mix design complies with these applications.

5. The asphalt content shall be established on the basis of absorption and bulk specific gravity tests conducted in accordance with ASTM C127 and C128.

6. The job mix formula shall list the following information:

    - The sieve analysis of the aggregate in the mix and its relationship to the specification limits.
    - The aggregate size range in each bin separation in the Contractor's asphalt plant.
    - For batch plants:

        a) the weight of material to be used from each bin for one batch of mix.
        b) the type of asphalt distribution system, adjustment and its setting for the required mix.

2G-3.0 DESIGN CRITERIA (cont'd)

- For continuous mix plants:

  a) the calibration curves for each bin's gate opening showing the setting for each gate for the required mix.
  b) the type of asphalt distribution system, the method of adjusting and its setting for the required mix.

7. The Contractor shall arrange for the qualified testing laboratory that prepared the mix design and job mix formula to calibrate and set his asphalt plant in accordance with the approved job mix formula. Trial mixes shall be tested to conform with the mix design prior to placement of asphaltic concrete on the job site. Allowable tolerances in the proportioning of asphaltic concrete ingredients shall be as follows:

   - asphalt cement - the percent of asphalt cement within the mix shall not vary more than 0.25% from the mix design.

   - aggregate - the weight of the aggregate from any bin as well as the total weight of aggregate for each batch in batch plants, and the gate openings for each bin in continuous mix plants shall not vary more than 0.5% from the approved job mix formula.

8. Stockpiling of at least 50% of the total quantity of aggregate required shall be completed prior to actual commencement of asphaltic concrete mixing operations. All aggregate shall be handled in such a manner as to prevent contamination and segregation.

2G-4.0 EQUIPMENT

1. Crushing Equipment

   The crushing equipment shall be well maintained at all times and produce aggregate meeting the specification requirements at a rate in excess of the asphalt mixing plant capacity.

2. Asphaltic Mixing Plant

   The asphaltic mixing plant shall be so constructed, maintained and operated as to consistently produce a product meeting the specifications. Monitoring devices shall be maintained in operating condition and guide the plant operations within the bounds of good practice as established by the Asphalt Institute.

3. Drier

   The drier shall deliver aggregate uniformly heated to the temperature specified and retaining less than one-half of one percent (0.5%) by weight of moisture. The drier shall be fired with propane or natural gas. An efficient dust collecting system shall be employed to exhaust the drier.

2G-4.0 EQUIPMENT (cont'd)

4. Screens

   The screens and hot stone elevator shall be totally enclosed. The capacity of the screens shall be such that they will operate in excess of production mixing unit. The maximum override allowed on any screen shall be 15 percent. The screens and hot stone elevators shall exhaust to the dust collector.

5. Dust Collectors

   The dust collector system shall be adequate to meet zoning and Public Health requirements and shall efficiently collect the fumes exhausted from the drier, screens and mixing unit and return all or any portion to the mixing unit.

6. Bins

   The plant shall be equipped with at least three bins exclusive of any arrangements for the addition of mineral filler. The selection of screen cloth sizes shall be at the Contractor's discretion as long as the bin utilization is approximately equal for all bins. Individual bins shall be partitioned in such a manner as to prevent overflow between bins. Each bin shall be equipped with an adequate overflow pipe leading to the outside of the bin.

7. Asphalt Tanks

   Asphalt cement shall be stored in clean, insulated tanks that are heated with circulating hot oil coils. The storage tanks shall be capable of heating the asphalt cement to any temperature between 135°C and 177°C as recommended by the mix design or as directed by the Engineer. Once a suitable mixing temperature has been established, the asphaltic cement shall be maintained at that temperature plus or minus 5°C.

8. Thermo-Metric Equipment

   The plant shall be equipped with a potentiometer or thermocouple with a range between 38°C and 260°C in divisions of 1°C.

   Temperature sensing heads shall be positioned in the following locations:

   (a) drier discharge;
   (b) bottom 1/3 point of fines bins; and
   (c) bottom 1/3 point of asphalt tanks.

   All asphalt lines, pug mills and asphalt pump or weight bucket shall be jacketed and hot oil heated.

2G-4.0 EQUIPMENT (cont'd)

9. Special Requirement for Batch Plants

   The pug mill shall be capable of mixing at least 900 kg per batch. Aggregate scales and asphalt bucket scales shall bear a current sticker certifying that they have been inspected and passed by the Department of Weights and Measures.

10. Special Requirements for Continuous Mix Plants

    The bins shall discharge onto a common or interlocked feeder apron or aprons. Gates at the discharge of the bins shall be calibrated by the Contractor and set in such manner as to deliver the correct amounts of aggregate to meet design requirements at all times. The operation of the bin feeders shall be interlocked with the asphalt pumps.

    The asphalt pumps shall be calibrated and set by the Contractor to consistently deliver the specified asphalt content with 0.25% of design.

    The pug mill shall be of length and design that asphalt and aggregate are consistently uniformly mixed.

11. Mixing Temperature

    Asphaltic concrete shall be mixed at a temperature giving a minimum kinematic viscosity of 180 centistokes. The lowest temperature in this range that results in a consistently uniform, well-mixed production, shall be "mix temperature", the mix temperature shall be maintained at all times within plus or minus 5°C.

12. Trucks

    The asphaltic mix shall be delivered to the road in clean, insulated trucks. Excessive lubrication of the truck boxes shall not be permitted.

    A temperature loss in excess of 11°C between mixing and placing shall result in rejection of the load.

    Trucks shall be equipped with waterproof tarpaulins of an adequate size to cover the load. Tarpaulins shall be used whenever the air temperature is less than 15°C. Trucks shall deliver hot-mix material at a temperature within ± 8°C of the temperature specified by the Engineer.

2G-4.0 EQUIPMENT (cont'd)

13. Paver

    The paver shall be either crawler mounted or pneumatic tired of an approved manufacturer. It shall be operated by competent personnel and maintained in good working order such that it lays a mat of uniform consistency true to line and grade, free from segregation or leaving tamper marks. It shall be adjustable to lay a mat in one pass between 240 cm wide and 365 or more cm and to a depth of between 35 and 100 mm. The screen shall be adjustable such that transition elevations are gradual and free of ripples and humps.

    The paver shall be equipped with an approved propane fired joint heater working in conjunction with the paver's operation. This heater shall be used to heat cold longitudinal joints.

2G-5.0 PRODUCTION AND PLACEMENT

2G-5.1 Base Preparation

1. Prior to the placement of asphaltic concrete or prime and tack coats over prepared bases, the Contractor shall ensure that all soft spots, irregularities in the grade, loose gravel sections, rocks, debris and all deleterious materials have been removed. All compaction test results shall meet the requirements of the Specifications prior to commencement of asphalting. If ordered by the Engineer, the Contractor shall supply and operate a load test vehicle of 8200 kg axle load to test the subbase and base for excessive rutting. The load test will be directed by the Engineer, and the Contractor shall pay for the test vehicle and for any repairs required to the road base.

2. In areas where new pavement is placed over old pavement, the surface of the old pavement shall be scraped and swept of all undesirable materials prior to the application of a tack or prime coat.

3. Where new pavement ties to existing pavement, the existing pavement must be cut straight and vertical with no jagged edges and all undesirable materials removed prior to the application of the tack coat.

4. Where the asphaltic surface course is placed in 2 lifts, the surface of the first lift shall be thoroughly cleaned of dirt or other deleterious material. A tack coat may not be required, depending on the condition of the first lift. If the Engineer decides that a tack coat is necessary, the Contractor shall apply the tack coat for the unit cost outlined in the Schedule of Quantities.

5. Where asphaltic concrete is to be placed over previously prepared and primed base, the prime coat shall be properly cured, and loose rocks, soft spots, rocks and debris shall be removed prior to paving operations.

2G-5.2 Adjustment of Utility Appurtenances

1. Prior to placing of asphaltic concrete, the Contractor shall adjust the utility appurtenances to an elevation of 10 mm below the finished elevation of the asphaltic pavement.

   The Contractor shall take special care in setting the “tilt” of the appurtenance so that the face matches the finished road face with the allowance designated above. He shall also ensure that the backfill around the appurtenance is fully compacted so that no settlement can occur.

   - manholes and catch basins shall be adjusted by adding to or removing bricks or grade rings with the existing manhole and regrouting the frames into place.

   - water valve boxes shall be adjusted by sliding the valve box up or down; however, the standpipe shall be adjusted to be not lower than 50 mm above the bottom of the valve box and not higher than 150 mm below the top of the valve box. Short standpipes shall be lengthened by adding a short section (complete with a coupling) of the same size and type of pipe used for the existing standpipe.

2. During paving operations, the Contractor shall locate and expose all utility appurtenances prior to rolling operations commencing.

2G-5.3 Application of Tack and Prime Coats

1. The Contractor shall supply an approved distributor that shall have an insulated tank complete with a heating system, a thermometer and a power-driven pump capable of handling light or heavy asphalt cements at spraying viscosity. Also, it shall have a valve system to govern the flow, a pump tachometer or pressure gauge and a bitumeter or other device that will indicate the number of metres per minute and total distance traveled. The distribution of primer or tack coats shall be uniform through each nozzle in the spray bar.

2. Tack coats shall be applied against transverse and longitudinal joints, edges of existing gutters, sidewalks, manhole frames, valve boxes, catch basins and all other structures that will be in contact with the asphaltic pavement.

3. Prime and tack coats may be applied when the ambient temperature is above 4°C, providing that the Engineer has approved the base work, and that the wind conditions are not hazardous enough to cause damage to surrounding property.

2G-5.4 Transportation of Asphaltic Concrete

1. The boxes of the vehicles shall be sprayed lightly with diesel fuel or some other product to prevent the asphalt mix from adhering to their sides.

2. The boxes of the vehicles shall be insulated to prevent any undue loss of heat from the mixtures.

2G-5.4 Transportation of Asphaltic Concrete (cont'd)

3. Loads of asphaltic concrete shall be covered with a tarpaulin or like material when hauling the mixtures under the following conditions:

    - the ambient air temperature is below 15°C
    - the mix has to be hauled in excess of 10 km
    - when extremely dusty conditions are prevalent
    - during rain

4. When tarpaulins are used, they shall not be taken off until immediately before the vehicle is unloaded.

2G-5.5 Workmen and Equipment

1. Mechanical, self-propelled paving machines shall be capable of spreading the asphaltic mixture to the specified tolerance, true to line, grade and crown. The paving machine shall be equipped with a speed that will produce an even, uniform texture surface. During paving operations the hopper shall be dumped between alternate truckloads to prevent cooling of any material left on the sides.

2. Compaction equipment required to compact the mix to the minimum Marshall Density shall be supplied and operated by the Contractor.

    - steel-wheel rollers shall be equipped with adjustable scrapers to keep them clean and must be kept wet to prevent asphalt from sticking to the rollers.

    - wheels shall be truly round and smooth without flat spots, openings or projections.

    - pneumatic-tired rollers shall be self-propelled with all wheels of equal size and diameter.

        a) wheels shall oscillate but not wobble.
        b) tire pressure shall be uniform in all wheels
        c) tires shall be sprayed with diesel fuel or some other product to prevent asphalt from sticking on them
        d) small sidewalk rollers, hand tampers and other compaction equipment shall be supplied by the Contractor and used in restricted areas.

3. The vehicles transporting the mix shall be of sufficient size, condition, and capable of adequate speed to ensure an orderly and continuous operation.

    - the vehicles transporting the mix shall not be loaded heavier than their legal licensed weight.

    - asphaltic concrete mixtures shall be transported from the mixing plant to the work site in vehicles with tight metal boxes previously cleaned of all foreign materials.

2G-5.5 Workmen and Equipment (cont'd)

4. Competent workmen shall be provided by the Contractor to correct incidental pavement irregularities, ensure straight edges for alignment for each course, and to adjust the paver for crossing over manholes, catch basins, valve boxes, etc.

2G-5.6 Placement

1. Minimum Asphaltic Concrete placement temperatures shall conform to the following table as reproduced from *The Asphalt Institute's (SS-1) Fifth Edition, Nov. 1975*:

Minimum Placement Temperature					
	Mat Thickness, mm				
Base Temp. °C	25	38	50	75	100
- 4 - 0					126*
+ 0 - 4			146	137	126
4 - 10		148	140	135	124
10 - 15	148	146	137	132	124
15 - 20	143	140	135	129	121
20 - 25	140	137	132	129	121
25 - 30	135	132	129	126	121
+ 30	132	129	126	124	121
Rolling completed after placing time, minutes	8	12	15	15	15

2. The mix design and job mix formula shall be received and approved by the Engineer and, as all base work, shall be inspected and approved by the Engineer prior to commencement of paving operations. The Contractor shall have an adequate supply of equipment on-site to expedite the work in consideration with the volume of asphalt materials being hauled and the prevailing weather conditions.

3. The asphaltic mixture shall be spread with an approved mechanical paving machine. The paving machine shall be positioned to overlap the edge of the previously placed mat by 50 mm. All joints shall be painted with an asphaltic tack coat.

4. All seams shall be raked and the coarse aggregate picked up by a shovel and removed from the mat. Under no circumstances shall coarse aggregates be spread over the fresh asphalt mat. Asphaltic concrete placed against curbs, manholes, valve boxes, and catch basins shall be left 6 mm to 10 mm higher after rolling.

5. Asphaltic pavements over 75 mm thick or as specified in the Special Provisions shall be placed in two equal thickness lifts that are aligned in such a manner that transverse and longitudinal joints do not coincide and are a minimum of 1 metre apart.

2G-5.6 Placement (cont'd)

6. In narrow areas, deep or irregular sections, intersections, turnouts or driveways where it is impractical to spread with a paver, the Contractor shall use hand methods.

7. Transverse joints shall be made by cutting back in a straight line on the previously spread rolled mat in order to expose its full depth and cross section.

    - a piece of lumber the same thickness as the compacted mat shall be placed across the freshly paved mat at the end of each day's run.

    - the exposed edge shall be painted with an approved bituminous tack coat and heated to at least 65°C with an approved heater before beginning paving from that joint.

    - freshly laid asphalt shall be raked against the joint enough to provide a smooth joint free from ridges or depressions.

    - rolling procedures of transverse joints shall be done while the mix is still hot.

8. Longitudinal joints shall be made while the first mat is still hot. The asphalt mix shall be placed in the abutting lane and should be tightly crowded against the vertical face of the previously placed lane.

    - the first mat placed shall be true to line and have a near vertical face.

    - fresh asphaltic material shall be laid sufficiently higher than the previously laid mat to allow for compaction to the depth of the adjacent mat.

    - when previously laid pavement has cooled to a temperature less than 50°C, the pavement edge shall be either:

        a) thoroughly heated to a minimum temperature of 60°C for the full depth of the mat and to a similar distance from the joint by using an approved heating system.

        b) lightly painted with an approved bituminous tack coat

            - all longitudinal joints shall be raked. The coarse aggregate particles shall be removed from the joint and wasted.

            - all longitudinal joints shall be constructed to ensure that there will be a coincidence of surface plane free from ridges and depressions.

2G-5.7 Compaction

1. The Contractor shall use a steel-wheeled roller and a pneumatic tired roller for compacting the asphaltic mixture. Steel-wheeled rollers shall not exceed 5 km/hr. for pneumatic tired rollers shall not exceed 8 km/hr. during compaction operations. The line or direction of rolling shall not changed suddenly. Irregularities, ridges, or depressions resulting from sudden changes in the direction or line of rolling operations shall be immediately repaired by the Contractor. Rollers or other equipment shall not be permitted to stand on fresh or freshly finished surfaces until it has been thoroughly rolled and set.

2. The Contractor's rolling procedures shall conform t the latest recommendations of *The Asphalt Institute*. Breakdown rolling shall be accomplished with steel-wheel rollers, immediately behind the breakdown roller while the mix is still plastic and hot.

3. Second rolling shall be performed in order that the asphaltic concrete mixture be compacted to the following minimum in-place densities:

April 15 - Aug. 31	97% of Marshall design density - ASTM D1559-76
After Aug. 31	98% of Marshall design density - ASTM D1559-76

4. Second rolling shall be continuous. Finishing rolling shall be accomplished with steel-wheeled rollers while the material is warm enough for the removal of all roller marks. In narrow or other areas where it is impossible to use mechanical compaction, the Contractor shall use hand tampers.

2G-5.8 Surface Qualities

1. After all rolling operations have been completed, the asphalt surface shall be true to the designed crown and grade and have a smooth riding quality.

    - surfaces of finished pavement shall be free from depressions exceeding 5 mm as measured with a 3 metre straight edge parallel and perpendicular to the road centerline.

    - the elevation of the finished asphalt surface shall not be more than 10 mm above or below the elevations shown on the Contract Drawings.

    - the finished surface shall not contain any variations which will impede drainage.

    - the horizontal alignment of the asphalt roadway shall not deviate more than 10 mm from the alignment as shown on the Contract Drawings.

2G-5.9 Clean Up

1. The Contractor shall remove all rubbish, debris, gravel and asphalt generated by his paving operations from the site.

2. New asphaltic pavement and other areas affected by the work shall be swept of all dust and washed. The site shall be left in a first-class condition.

2G-6.0 QUALITY CONTROL

2G-6.1 Testing and Inspection

1. The Engineer shall have access to all parts of the asphalt plant for checking mix proportioning and other quality control testing. Also, he shall have access to all other parts of the Contractor's paving operations for quality control investigations.

2. The frequency and type of asphalt testing shall be determined by the Engineer but usually will not be more than the following:

   Mix Tests - minimum of 1 set for 1,000 tonnes
   Tested for:
   - asphalt content
   - sieve analysis
   - briquettes
     - density
     - Marshall stability
     - flow

   Core Samples - minimum of 1 core for 500 square metres per asphalt mat
   Tested for:
   - asphalt content
   - sieve analysis
   - thickness
   - density
   - Marshall stability
   - flow
   - VMA
   - air voids

3. The Owner will only pay for successful quality control test results. Unsuccessful test results will be paid for by the Contractor.

2G-6.2 Cosmetic, Thickness and Characteristic Deficiencies

1. For asphaltic pavement that does not meet a specified minimum thickness, the following densities shall be applicable.

   a) areas deficient in depth by 10% or less of the specified minimum thickness shall be paid for at the Contract Unit Price multiplied by the ratio of the square of the actual thickness to the square of the specified minimum thickness.

      Formula:

      $$\text{Adjusted Unit Price} = \text{Contract Unit Price} \times \frac{(\text{actual thickness})^2}{(\text{specified thickness})^2}$$

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2G-6.2 Cosmetic, Thickness and Characteristic Deficiencies (Cont'd)

b) areas deficient in depth by over 10% of the minimum rough surface shall be corrected by one of the following procedures:

- an overlay, of an approved mix design, of sufficient depth to increase the overall minimum thickness to those specified. In no case shall the overlay be less than 15 mm thick.

- removal of the deficient area and replacement with the specified thickness.

2. The Contractor shall pay for testing as specified by the Engineer.

3. The Engineer, in consultation with the local approving authority, shall deem which method is to be used.

2G-7.0 MEASUREMENT AND PAYMENT

1. Measurement for asphaltic concrete shall be the actual number or square metres of accepted asphaltic concrete pavement actually incorporated into the work.

2. Payment for asphaltic concrete shall include all field layout, haul, placement, preparation of mix design and job mix formula, tack and prime coats, tie-ins, equipment, material, labour, supply of asphaltic concrete, clean-up, and all other incidentals required to complete the work in accordance with the Contract Documents.

2G-7.1 Asphaltic Concrete Pavement

1. The measurement of asphaltic concrete shall be the centreline of the roadway for the specified width and depth or tonnage as determined on a scale meeting the requirements of these Contract Documents. The width of asphalt will be measured as actual dimension of asphaltic concrete placed and will not include any shouldering widths where gravel shoulders are specified or any concrete curb sections where curbs and shoulders are used.

2. Payment for asphaltic concrete shall be made in accordance with the Contract Unit Price as outlined in the Schedule of Quantities.

3. No payment will be made for a thickness greater than that specified in the Schedule of Quantities.

2G-7.2 Tack and Prime Coats

1. Measurement of asphaltic tack and prime coats shall be specified distribution.

2. Payment for tack and prime coats shall be made in accordance with the Contract Unit Price per square metre.

2G-7.2 Tack and Prime Coats (Cont'd)

3. Payment for tack and prime coats may not be a separate item within the Schedule of Quantities and may be all-inclusive with the Contract Unit Price for Asphaltic Concrete.

2G-7.3 Adjustment of Utility Appurtenances

1. Measurement for the adjustment of utility appurtenances shall be made on either a per unit basis or by measuring the vertical distance that the appurtenance is to be raised or lowered.

2. When applicable, payment for adjustment of utility appurtenances shall be made in accordance with the Contract Unit Price as outlined in the Schedule of Quantities, and shall include the supply and installation of all materials to complete the adjustment. There shall be no additional payment made for temporary lowering of appurtenances or for locating or protecting of these appurtenances.

   No payment will be made for appurtenances if the installation of the utility appurtenance is installed in this Contract. Payment for these appurtenances shall be made in accordance with the Contract Unit Price as outlined in the Schedule of Quantities.

2G-7.4 Driveways and Small Areas

1. Measurement of driveways and small, irregular-shaped areas as specified on the Drawings shall be measured along rectangular and triangular sections or by the tonnes as determined on a scale meeting the requirements of these Contract Documents.

2. Payment for driveways and small, irregular-shaped areas shall be made in accordance with the Contract Unit Price as outlined in the Schedule of Quantities and shall also be full compensation for excavation to subgrade, supply and placement of specified crushed gravel, and specified asphaltic concrete pavement.

2G-7.5 Asphalt Tie-Ins/Utility Cuts

1. No payment will be made for the cutting or existing asphalt at tie-in points or for utility cuts. Payment shall be all-inclusive in the Contract Unit Price in the Schedule of Quantities.

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DIVISION 3 - CONCRETE
SECTION 3A - CAST-IN-PLACE CONCRETE

3A-1.0 GENERAL

3A-1.1 Scope

1. These specifications refer to all concrete work.

3A-1.2 References

1. As applicable, the following is referred to:

   a) British Columbia Building Code
   b) CSA A23.1-09 (or latest edition)
   c) CSA A23.2-09 (or latest edition)
   d) CSA A23.3-09 (or latest edition)

2. The Contractor shall have at least one copy of CSA A23.1 and A23.2 on the jobsite at all times and shall be familiar with same.

3A-1.3 Testing

1. The Owner will arrange for materials tests but the Contractor may provide for his own testing. Quality of materials and workmanship is sole responsibility of the Contractor.

3A-1.4 Notification

1. The Contractor is to advise the Engineer at least 48 hours in advance of any concrete pour.

3A-2.0 PRODUCTS

3A-2.1 References

1. Concrete materials: CSA A23.1-09 (or latest edition)
   Concrete Testing: CSA A23.2-09 (or latest edition)

3A-2.2 Mix Designs

1. Except if specified, concrete to be as per Alternative 1, Clause 4.1.2 (Table 5)

2. Mix designs to be prepared over seal and signature of a Professional Engineer currently on the B.C. Register. (Exception: if written permission is obtained from the Consultant.)

3A-2.3 Concrete Criteria

1. Cement: Type 10 (CSA-A5)

2. All concrete to conform to Clause 4, (Tables 1 & 2)

3. Strengths:

Lean concrete not exposed to water or weather:	10 MPa
Lean concrete exposed to water or weather:	15 MPa
Structural:	25 MPa
Sidewalks, Curbs, Gutters, Pavements and Hydraulic Structures:	32 MPa

4. Exposure Classes:

Sidewalks, curbs, gutters and Pavements:	C-2
Concrete immersed in water, sewage or exposed to wetting:	F-1
Structural concrete in the interior of British Columbia:	F-2
Concrete Inside Buildings:	N

5. Nominal Size coarse Aggregate: 20mm

6. Air Content: as per Clause 4.4.4 (Table 4)

7. Admixtures: as shown or as approved

3A-2.4 Reinforcement

1. Deformed bars to CSA G30.12 with minimum yield strength of 400 MPa conforming to Clause 6.1.

2. Welded wire Fabric: to CSA G30.5

3A-2.5 Hardware

1. to Clause 6.2, fabricated to CSA S16

3A-2.6 Storage - to Clause 5.1

3A-2.7 Testing

1. Mill-test certificates may be required.

2. Samples of reinforcement may be tested.

3. Concrete to be tested per Clause 4.4 and CSA A23.2

4. Air tests for concrete with Exposure Class C-2 and F-1 will be for every load.

3A-3.0 EXECUTION

3.1 Formwork

1. to WCB regulations
2. to Clauses 6.4 and 6.5 except if shown otherwise

3.2 Construction Joints

1. To Clause 7.3 with advance documentation

3.3 Placing of Reinforcement and Hardware

1. to Clauses 6.6 and 6.7

3.4 Placing Concrete to Clauses 5.2 and 7.2.

3.5 Curing and Protection to Clause 7.4.

3.6 Toppings to Clause 7.6.

3.7 Finishing

1. to Clauses 7.5, 7.6, 7.7 and 6.8
2. unless shown differently:

Exterior Slabs:	broom finish
Interior Slabs:	steel trowel finish
Curbs and Gutters	floating Formed
Formed Surfaces	to Clause 7.7 except if shown differently

3.8 Inadequacies:

1. Materials with inadequacies discovered prior to installation: not to be used;

2. Materials with inadequacies discovered after installation:

   a) to be replaced at Contractor's expense.
   b) to be accepted under remedial conditions proposed by the Contractor and accepted by the Consultant.

POWDER COAT SPECIFICATION

1.0 POWDER COATING MATERIALS FOR COATING GALVANZIED SURFACES

.1 The powder coating system shall consist of two components: an epoxy primer coat and polyester finish coating. The epoxy primer coat the polyester finish coating materials shall be from the same manufacturer.

Property	Specification	Performance Requirement
Adhesion	ASTM D 3359	5B (no failure)
Flexibility	ASTM D 522 Method B	Pass 1/8" mandrel bend
Pencil Hardness	ASTM D 3363	H Plus
Specific Gravity	ASTM D 792	1.25 minimum
Graffiti Resistance	ASTM D6578	Cleanability level "1"

.2 The polyester finish coat shall conform to American Architectural Manufacturers Association (AAMA) specification 2604.

.3 Degassing additives may be added as necessary to prevent pin holes in the finish coat. The degassing additives shall be added in accordance with manufacturer's recommendations.

.4 The colour of the powder coating system polyester finish coat shall be as specified in the Plans of Special Provisions. The primer shall be a minimum 8 mils thick.

.5 The top coat shall be a minimum of 4 mils thick.

.6 Repair materials shall be selected from one of the approved products list in the current Qualified Products List and specified in the Contractor's powder coating plan as approved by the Engineer.

.7 Engineer shall be notified of delivery date for inspection of pole(s). Scratched, chipped, and otherwise damaged poles will be rejected.

END OF SECTION

ELECTRICAL GENERAL PROVISIONS

1.0 GENERAL

1.1 Work Included

.1 Supply and install all wiring, materials, equipment, etc., shown or required unless otherwise specified. Any item or system which is shown, mentioned or reasonably implied on either the drawings or in the specifications shall be considered to be properly and sufficiently specified and shown, and must be provided. Include all labour, equipment, tools, etc., required to complete all installations as intended. Install all equipment according to the method indicated, manufacturer's instructions and according to standard industry practices.

.2 Refer to the Instructions to Bidders and General Conditions of the Specifications and conform to all requirements.

.3 During the course of construction and testing, contractor shall report any equipment that fails to operator correctly, is damaged, or is in a condition that will not allow it to last for another 5 years. Contractor must provide, on request, a time and material estimate to repair or replace the faulty equipment. No additional work shall be undertaken without an estimate and approval in writing by the Engineer and the Owner.

.4 Cables shall be installed as per manufacturer's guidelines. Only proper pulling equipment shall be utilized. Minimum bending radii and cable pulling tension shall not be exceeded. Ducts and cables shall be neatly trained in trenches and shall be adequately supported. Contractor shall decide mean and set-up of pulling equipment and direction or pull. Plan to be reviewed with Engineer prior to set-up.

.5 All test and installation equipment shall be operated safely using the procedures outlined in the manufacturer's operating manual. Only personnel trained and qualified to operate the equipment shall perform this work.

.6 The contractor shall be responsible for all permits, locates and inspections necessary to successfully perform the work. The contractor will pay for all associated costs of the above and include these costs in his proposal.

1.2 Scope of Work

.1 Details regarding materials and installation methods are covered in the accompanying specifications. The drawings included in the package show the general layout of the work and include details regarding the installation.

1.3 Rules, Regulations and Permits

.1 Provide all work and materials in accordance with the latest editions of the Electrical Safety Code, the Building Code, applicable CSA Standards, the requirements of the

Electrical Safety Authority, and all other applicable Municipal and Provincial codes and regulations. Any materials, equipment or installations not meeting all requirements of the appropriate regulatory agencies will not be accepted. It is the Contractor's responsibility to ensure these requirements are met and provide evidence of such.

.2 Obtain and pay for all permits and fees for the execution and inspection of the electrical work. All work shall be provided by qualified journeyman electricians or apprentices holding valid Certificated of Qualification and be supervised by a competent foreman. The contractor shall also be a registered Master Electrician if such is required in the particular municipality where the work is performed. Certificates verifying that the installation and equipment meets all applicable inspections shall be presented to the Engineer.

.3 The Contractor is obliged to inform the Engineer immediately of any contradiction or omission in the specifications or drawings relating to conformance with the aforementioned codes and standards so that it can be corrected prior to tender closing. Failure to do so will not relieve the Contractor from meeting the intent of paragraph 3.1.1.

.4 Provide all necessary grounding as required by Electrical Safety Authority regardless of whether it is shown on the drawings.

.5 All necessary cutting and patching for the electrical work will be provided by the appropriate skilled subtrade with at least 5 years skill-specific experience at the expense of the Contractor. Holes through exterior walls are to be flashed and made weatherproof. Repair any damage caused by the Contractor to existing buildings, equipment, or grounds, etc., to the satisfaction of the Engineer, and the Owner. Upon completion of the work, clean all equipment and remove from the site all debris associated with the work of all trades.

.6 Provide legible signs and barriers on or around all live panels and test equipment during construction and testing to prevent injury or shock.

.7 Test all equipment and wiring at any time requested by the Engineer as part of the Contract. Provide all meters, materials and qualified personnel required to perform this work.

.8 The Contractor and all associated sub trades must carry proper and adequate liability insurance to protect all affected parties *including* the Owner and the Engineer from all claims related to their work for this project.

.9 Perform all work in such a manner as to cause as little disturbance or inconvenience as possible to the existing operations of the owner. Ensure that all outages are coordinated with the Owner's designated representative. Provide temporary

measure (such as electrical power) as may be required from time to time by the Owner or the Engineer.

.10 Provide all sleeves, inserts, and hangers required for the electrical work. Treat all sleeves or holes piercing acoustical separations for installations of this Division to maintain acoustical rating. All gaps shall be packed with acoustical insulation and sealed at both piercing fire and smoke separations with an approved watertight smoke and fire stop sealant such as manufactured by Dow Corning. All penetrations requiring fire stops shall be sealed with materials consistent with the required fire rating.

.11 Plan work well in advance to eliminate delivery and installation difficulties. Co-ordinate work with other trades to prevent conflicts on site. Any additions costs that are borne by the Owner resulting from the Contractor's failure to do so shall be the responsibility of the Contractor.

1.4 Drawings

.1 Drawings which accompany these specifications are diagrammatic and show the required distribution, number and locations of the electrical equipment, fixtures, and outlets and indicate suggested circuiting. Where exact building dimensions and details are required, use only job site dimensions.

.2 Submit shop drawings for all items and equipment to the Engineer for approval prior to ordering of the material.

.3 Provide a complete set of As-Built drawings to the Engineer, indicating in red ink all deviations and approved changes from the Contract Drawings.

1.5 Guarantee

.1 Provide a written guarantee that covers all materials and installations of all work performed under the contract for this project. The guarantee shall extend for a period of one year from the date of final acceptance of the work.

1.6 Equipment, Materials and Methods

.1 Where there are questions arising from the specifications, the drawings, or the underground plans, it is the responsibility of the Contractor to obtain clarification from the Engineer. Do not proceed in uncertainty.

.2 All items installed must be CSA approved for the particular application. All work and installations must be acceptable to the equipment manufacturer or system supplier and be approved by Electrical Safety Authority. All materials specified with manufacture's name, type, etc., are to establish type and quality of materials required and first choice of manufacturer. Equivalent materials by other

manufactures may be used, but only after obtaining approval form the Engineer. Unless otherwise specified, used equipment and material shall not be used.

.3 Generally, mount equipment as close to practical to the location shown on the drawings taking into account site conditions. Ensure all equipment is located in a manner allowing easy access for maintenance, repair, or adjustment.

.4 The Engineer reserves the right to relocate any outlet, equipment, etc., up to 10 feet prior to installation without incurring any extra cost.

.5 Provide outlet boxes of adequate size and type and approved as required for all wiring devices, light fixtures etc. Provide junction boxes as required and secure all boxes independent of the conduit/wiring system.

.6 Use only approved conduit and raceways of adequate size to suit type and number of conductors being carried. Every section of conduit or armoured cable shall be adequately secured using approved supports, clamps, and fasteners. All conduit or armoured cable run in finished areas shall be concealed in walls, ceiling, or furring unless otherwise approved the Engineer.

.7 All conductors used shall be copper.

.8 Identify all new equipment such as panels, cabinets, starters, contactors, disconnect switches, etc., with "Lamacoid" plates with ½ " high lettering. Label all junction boxes with black marker identifying circuits, panels, and systems.

END OF SECTION

WIRE AND CABLE

1.0 GENERAL

1.1 Work Included

.1 Building wire.

.2 Cable.

.3 Wiring connections and terminations.

1.2 Related Work

.1 This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for wire and cable.

.1 Section 26 05 01- Electrical General Provisions.

.2 In the event of conflict regarding wire and cable requirements between this Section and any other section, the provisions of this Section shall govern.

1.3 Submittals

.1 Submit manufacturer's product data for all cables and conductors furnished under this Section.

.2 Submittals shall be made in accordance with the provisions of Section 01300, Submittals, and the requirements of this Section.

2.0 PRODUCTS

2.1 Building Wire

.1 Thermoplastic-insulated Building Wire: C22.2 No.75-M1983 (R1992)

.2 Thermoset-insulated Building Wire: C22.2 No.38-95

.3 Feeders and Branch Circuits 6 AWG: Copper, stranded conductor, 600 volt insulation, RW90. Underground circuits to be RWU90 XLPE-TR insulation.

.4 Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation, T90, stranded conductor.

.5 Control Circuits: Copper, stranded conductor 600 volt insulation, T90 or TEW.

2.2 Armoured Cable

.1 Armoured Cable, Size 14 Through 6 AWG: Copper stranded conductor, with CSA certified liquid and vapour-tight solid interlocked aluminium or interlocked galvanized steel armour, 100V PVC jacketed insulation, rated 90°C, type TECK90.

.2 Armoured Cable, Size 4 and larger: Copper stranded conductor, with CSA certified liquid and vapour-tight solid interlocked aluminium or interlocked galvanized steel armour, 1000 volt PVC jacketed XLPE insulation, rated 90°C, type TECK90.

.3 Armoured Cable, Hazardous Areas: Copper stranded conductor, with CSA certified interlocked aluminium or interlocked galvanized steel armour suitable for use in Hazardous Locations (Class 1, Div. 1), 1000V XLPE insulation, fire retardant (FR) and low acid gas (LAG) PVC jacketed, rated 90°C, type TECK90. Sizes as per drawings.

3.0 EXECUTION

3.1 General Wiring Methods

.1 Use no wire smaller than 12 AWG for power and lighting circuits, no smaller than 14 AWG for control wiring, and no smaller than 16 AWG for fire detection system wiring.

.2 Place an equal number of conductors for each phase of a circuit in same raceway or cable.

.3 Splice only in junction or outlet boxes. Control cables shall not be spliced.

.4 Neatly train and lace wiring inside boxes, equipment, and panelboards.

.5 Ensure that conductor lengths for parallel circuits are equal. Parallel conductor runs shall be sizes #1/0 AWG or larger, and all of the same conductor size.

.6 Where connection of cables installed under this section are to be made by others, provide pigtails of adequate length for neat, trained and bundled connections.

3.2 Wiring Installation in Raceways

.1 Pull all conductors into a raceway at the same time. Use CSA-listed wire pulling lubricant for pulling 4 AWG and larger wires.

.2 Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

.3 Completely and thoroughly swab raceway system before installing conductors.

3.3 Cable Installation

.1 Provide protection for exposed cables where subject to damage. Ensure cables and ducts coming up through the ground are mechanically protected.

.2 Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal clips to support cables from structure.

.3 Use suitable cable fittings and connectors.

.4 Armoured cables bent during installation shall have a curve radius of the inner edge of the bend that is at least 6 times the external diameter of the cable. Bends shall be made without undue distortion of the armour and without injury to its inner or outer surface.

3.4 Wiring Connections and Terminations

.1 Splice only in accessible junction boxes. Splices in power cables will not be allowed.

.2 Use compression type connectors for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps on lighting and receptacle circuits.

.3 Thoroughly clean wires before installing lugs and connectors.

.4 Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

.5 Terminate spare conductors with electrical tape.

.6 Splices below grade are not allowed.

3.5 Field Quality Control

.1 Inspect wire and cable for physical damage and proper connection.

.2 Torque test conductor connections and terminations to manufacturer's recommended values or to Table D6 or D7 in the CEC.

.3 Perform continuity and insulation tests on all power and equipment branch circuit conductors. Verify proper phasing connections.

3.6 Wire and Cable Installation Schedule

.1 As per drawings.

END OF SECTION

GROUNDING AND BONDING

1.0 GENERAL

1.1 Related Documents

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

.1 This Section includes methods and materials for grounding systems and equipment.

1.3 Submittals

.1 Product Data: For each type of product indicated.

.2 Field quality-control test reports.

1.4 Quality Assurance

.1 Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

.1 Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3

.2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

.3 Comply with UL 467 for grounding and bonding materials and equipment.

2.0 PRODUCTS

2.1 Conductors

.1 Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

.2 Bare Copper Conductors:

.1 Solid Conductors: ASTM B 3.
.2 Stranded Conductors: ASTM B 8.
.3 Tinned Conductors: ASTM B 33.
.4 Bonding Cable: 28 kcmil, 14 of No. 17 AWG conductor, ¼ inch (6 mm) in diameter.
.5 Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
.6 Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
.7 Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16inch (1.6 mm) thick.

2.2 Connectors

.1 Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

.2 Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

.1 Pipe Connectors: Clamp type, sized for pipe.

.3 Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 Grounding Electrodes

.1 Ground Rods: As required.

3.0 EXECUTION

3.1 Applications

.1 Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

.2 Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

.1 Bury at least 24 inches (600 mm) below grade.
.2 Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

.3 Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

.4 Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

.1 Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
.2 Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

.5 Conductor Terminations and Connections:

.1 Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
.2 Underground Connections: Welded connectors except at test wells and as otherwise indicated.
.3 Connections to Ground Rods at Test Wells: Bolted connectors.
.4 Connections to Structural Steel: Welded connectors.

3.2 Equipment Grounding

.1 Install insulated equipment grounding conductors with all feeders and branch circuits.

.2 Install insulated equipment grounding conductors with the following items, in addition to those required by the Canadian Electrical Code:

.1 Feeders and branch circuits.
.2 Lighting circuits.
.3 Receptacle circuits.
.4 Single-phase motor and appliance branch circuits.
.5 Three-phase motor and appliance branch circuits.
.6 Flexible raceway runs.
.7 Armoured and metal-clad cable runs.
.8 Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
.9 Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

.3 Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

.4 Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

.5 Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

.6 Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

.7 Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

.1 Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.

.2 Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

.8 Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 Installation

.1 Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

.2 Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

.3 Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

.1 Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

.4 Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

.1 Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
.2 Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
.3 Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

.5 Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

.6 Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

.7 Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of building.

3.4 Field Quality Control

.1 Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

CONDUITS

1.0 GENERAL

1.1 Work Included

.1 Rigid metal conduit and fittings.

.2 Electrical metallic tubing and fittings.

.3 Flexible metal conduit and fittings.

.4 Liquid tight flexible metal conduit and fittings.

.5 Flexible non-metallic conduit and fittings.

1.2 Related Work

.1 This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for conduit.

.1 Section 26 05 01 – Electrical General Provisions.

.2 In the event of conflict regarding conduit requirements between this Section and any other section, the provisions of this Section shall govern.

2.0 PRODUCTS

2.1 Rigid Metal Conduit and Fittings

.1 Rigid Steel Conduit: CSA C22.2 No.45-M1981 (R1992)

.2 PVC Externally Coated Conduit: rigid steel conduit with external 20 mil PVC coating and internal phenolic coating over a galvanized surface.

.3 Fittings and Conduit Bodies: Can/CSA 22.2 No.18-92; threaded type, material to match conduit.

2.2 Electrical Metallic Tubing (EMT) and Fittings

.1 EMT: CSA 22.2 No.83-M1995 (R1992); galvanized tubing.

.2 Fittings and Conduit Bodies: CAN/CSA 22.2 No.18-92; steel, set screw type.

2.3 Flexible Metal Conduit and Fittings

.1 Conduit: CSA 22.1 No.56-1977 (R1992)

.2 Fittings and Conduit Bodies: CAN/CSA 22.2 No.18-92

2.4 Liquidtight Flexible Conduit and Fittings

.1 Conduit: CSA 22.1 No.56-1977 (R1992) Flexible metal conduit with PVC jacket.

.2 Fittings and Conduit Bodies: CAN/CSA 22.2 No.18-92.

2.5 Liquidtight Nonmetallic Flexible Conduit

.1 Conduit: CSA 22.1 No.227.3-M1991 Flexible plastic conduit.

.2 Fittings and Conduit Bodies: CAN/CSA 22.2 No.18-92

2.6 Rigid PVC Conduit

.1 Conduit: CSA 22.1 No.211.1-M1984 (R1992); Rigid Types EB1 and DB2/ES2 PVC Conduit.

.2 Fittings and Conduit Bodies: CAN/CSA 22.2 No.18-92.

2.7 Conduit Supports

.1 Conduit Clamps, Straps, and Supports: Steel or malleable iron.

3.0 EXECUTION

3.1 Conduit Sizing, Arrangement, and Support

.1 Size conduit for conductor type installed, ¾ inch minimum size.

.2 Arrange conduit to maintain headroom and present a neat appearance.

.3 Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

.4 Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

.5 Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

.6 Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

.7 Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

.8 Do not notch structural members for passage of raceways except without prior review of the Engineer.

.9 Support conduit at distances as defined in the Canadian Electrical Safety Code.

3.2 Conduit Installation

.1 Cut conduit square using a saw or pipe cutter; de-burr cut ends.

.2 Bring conduit to the shoulder of fittings and couplings and fasten securely.

.3 Use conduit hubs [or sealing locknuts] for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet conditions.

.4 Install no more than the equivalent of three 90 degree bends between pull boxes.

.5 Use conduit bodies to make sharp changes in direction, as around beams.

.6 Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size. All parallel bends to be concentric.

.7 Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point. All conduits to enter from bottom or side, no top entry without Engineer's approval.

.8 Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

.9 Provide nylon pull string rope secured at each end of each empty conduit, except sleeves and nipples. Identify with tags at each end the origin and destination of each empty conduit.

.10 Install expansion joints for long runs or where conduit crosses building expansion joints.

.11 Where conduit penetrates fire-rated walls and floors, seal opening around conduit with CSA listed foamed silicone elastomer compound.

.12 Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket.

.13 Conduit in Slabs Above Grade: do not route conduits to cross each other in slabs above grade. Locate conduits in center one-third of slabs where possible.

.14 Concealed, embedded and buried conduits shall emerge at right angles to the surface and have none of the curved portion of the bend exposed.

3.3 Conduit Installation Schedule

.1 Underground Installations More than Five Feet from Foundation Wall: Direct bury Type DB2 PVC duct.

.2 Installations In or Under Concrete Slab, In Exterior Light Pole Foundations or Underground Within Five Feet of Foundation Wall: Schedule 40 PVC conduit.

.3 In Slab Above Grade: Rigid steel conduit.

.4 Exposed Outdoor Locations: Rigid steel conduit.

.5 Wet Interior Locations: Rigid steel conduit.

.6 Concealed Dry Interior Locations: Rigid steel conduit.

.7 Exposed Dry Interior Locations: Rigid steel conduit.

.8 Corrosive Interior Locations: PVC-coated rigid steel conduit.

.9 Hazardous (Classified) Locations: Rigid steel conduit.

END OF SECTION

PANELBOARDS

1.0 GENERAL

1.1 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.2 Plant Assembly

.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.

1.3 Panel Schedules

.1 Panel schedules indicating panel breakers and circuit assignments are indicated on the Contract Drawings.

.2 Single line diagrams indicate circuit breaker requirements in distribution panels.

2.0 PRODUCTS

2.1 Panelboards

.1 Panelboards: product of one manufacturer.

.2 250 V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity or as indicated.

.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 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Two keys for each panelboard and key panelboards alike.

.6 Copper bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim and door finish: air dried grey enamel or as per colour schedule.

.9 600 V Panelboards: bus and breakers rated for 22 kA (symmetrical) interrupting capacity.

2.2 Breakers

.1 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.2 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.3 Lock-on devices for 10% of 15 A breakers installed as indicated. Turn over unused lock-on devices to Owner.

.4 Lock-on devices for fire alarm, emergency exit and night lights circuits.

2.3 Equipment Identification

.1 Provide equipment identification in accordance with Section 25 05 01.

.2 Nameplate for each panelboard engraved as indicated.

.3 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4 Manufactures

.1 Acceptable manufacturers: Square D, Federal Pioneer, Westinghouse, Siemens, other if approved by Engineer.

3.0 EXECUTION

3.1 Installation

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, mount panelboards on common backboard.

.3 Mount panelboards to height specified in Section 25 05 01.

.4 Connect loads to circuits as indicated.

.5 Connect neutral conductors to common neutral bus.

.6 Run 2-25 mm spare conduits up to ceiling space from each recessed panelboard. Terminate these conduits in a 150 mm x 150 mm x 100 mm deep junction box in the ceiling space.

END OF SECTION

APPENDIX A

ENVIRONMENTAL MITIGATION

R5 Complete the ongoing Water Quality Monitoring as recommended in Section 9.1 to fulfill post-discharge monitoring requirements of the MWR.

R6 Follow the environmental mitigations in Section 10 to reduce project impacts.

9.1 Recommendations for Ongoing Water Quality Monitoring

We recommended tri-annual sampling for the parameters listed below at Upstream, Downstream 1 and Downstream 2 for two years following the initiation of the new discharge, after which the data should be reviewed by a qualified professional and the water quality monitoring program potentially adjusted as needed. Table 9.1 summarizes the recommended sampling schedule.

Table 9.1 Recommended Water Quality Monitoring Schedule

Project Site Name	EMS # and Name	Decimal Degree Lat/Long	Water Quality Monitoring Schedule		Parameters to Monitor
			Tri-Annual Sampling	Sample Months	
Upstream	E217521 Cadwallader Ck U/S Bralorne Mine	50.7757 122.8196	Years 1 and 2 after discharge at new outfall begins	April, June and September	• Speciated nitrogen • Total phosphorous • Ortho-phosphate • Total coliforms • *E.Coli*
Downstream 1	E217523 Cadwallader Ck at Bralorne Mine	50.7785 122.8229			
Downstream 2	E217522 Cadwallader Ck D/S Bralorne Mine	50.7889 122.8333			

10. ENVIRONMENTAL MITIGATION

Our environmental mitigation strategies follow *Standards and Best Practices for Instream Works* (MOE 2014). They include five main categories; Timing and Wildlife Management, Air Quality, Sediment Control, Environmental Monitoring and Vegetation and Site Restoration.

10.1 Timing and Wildlife Management

Clearing and trenching will be completed between during low water conditions in September of October of 2018. The reduced risk work timing window for Cadwallader Creek is from August 7-October 15 (MOE 2017a).

The migratory bird breeding window is between August 1 and March 31. Since proposed work is occurring outside of this window, a QEP will conduct a bird nest survey before clearing and excavation occurs. This could be completed at the same time as the *C. constrictor* investigation.

If a raptor, or other breeding nest is observed near the WWTP site, 1.5 tree lengths of undisturbed vegetation will be left around it. An additional 100 m "quiet buffer" will be honored beyond the vegetation buffer, whenever possible.

Any species of risk observed during the project should be reported to the BC Conservation Data Centre by the EM.

10.2 Air Quality

All equipment should be in excellent working order.

Engine air filters should be clean and functioning well.

Excavations and excavation material should be covered when work is not occurring.

If conditions are very dry and hot, excavation piles may need to be watered to keep dust under control during works.

10.3 Sediment Control

Silt fencing will be placed adjacent to works with the potential to add sediment to Cadwallader Creek at either of the proposed WWTP locations and during clearing and trenching for the outfall pipe (Figure 5 and Figure 6). A silt fence detail is included as Appendix E.

A silt curtain should be placed across Cadwallader Creek upstream and downstream of the works. The downstream silt curtain can be secured to the bridge. to isolate sediment release downstream of outfall placement (Figure 5). Silt curtain detail is provided in Appendix E.

Turbidity monitoring should occur upstream and downstream of the works. If turbidity increases by more than 8 NTU downstream of the isolated area, works should cease until waters clear.

All excavated material and debris will be stored above the top of bank and at least 30 m from Cadwallader Creek. Piles of temporarily excavated material will be covered with erosion blankets.

Open excavation should be covered and temporarily fenced off when work is not being completed to protect people and animals from entering.

Water pumped out of the excavations will be discharged to surface areas with granular soils at least 30 m from the river so that it does not enter any other watercourse, floodplain, ravine, or storm sewer system.

If lubricants are required below the wetted shoreline, then bentonite should be used rather than Enviro Gel. Additionally, every effort must be made to hold the lubricant pressure back and to minimize the bentonite mix.

10.4 Environmental Monitoring

Construction activities will be monitored full-time at start-up and during instream works or sensitive activity or otherwise daily, to the completion of the project. The EM will be on-site full-time during instream works, complete a fish salvage before works begin in the isolated area and monitor turbidity.

The environmental monitor (EM) will be a QEP provided with written authority to modify and/or halt any construction activity if deemed necessary for the protection of fish and wildlife populations or their habitats. A sign will be posted listing WWAL as the company completing the environmental monitoring and the WWAL phone number in the immediate vicinity of the job site.

A pre-construction meeting will be held between the environmental monitor and the contractor undertaking the work on the site to ensure an understanding of the mitigative strategies for the project.

A copy of this document and all appropriate plans, drawings and permits will be forwarded to the Ironman supervisor and kept readily available at all times at the site while the work is proceeding.

Within 60 days of completion of the project, the environmental monitor will complete and submit a copy of a monitoring report to the City of Enderby and a copy to the BC Ministry of Environment with the Notification File Number noted.

10.5 Vegetation and Site Restoration

Disturbance to existing vegetation will be as conservative as possible. The smallest excavator as possible will be used to clear and prune native vegetation and excavate the pit and linear excavation in the Right Bank Project Site.

Weeds will not be transported on or off the work site.

Plants will be removed whole and saved for transplanting whenever possible under advisement of the EM.

All large trees and snags used, or suspected of being used, by raptors as nesting sites will be avoided and left undamaged.

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All excavations will be graded to a stable angle of repose after work is complete.

Disturbed soil should be hydro-seeded using heavy mulch, tackifier and a seed mix suitable for riparian areas within the MSdc biogeoclimatic zone.

Silt fences, equipment, supplies and all construction materials will be removed from the site upon completion of works.

Natural woody debris should not be removed from the site as part of clean-up activities, unless directed by the EM/QEP.

Any sites that require native revegetation will be revegetated with locally sourced native plants using species selection, spacing and planting details provided by the EM in a Revegetation Planting Plan.

Every effort will be made not to harm vegetation within the Hybrid White Spruce / Horsetails / leafy Mosses Blue-listed Ecological Community. The EM will document vegetation species that have been damaged or removed so that they can be replaced once works are complete at a 3:1 ratio. These details will be summarized in a Revegetation Planting Plan attached to the monitoring report.

APPENDIX B

GEOTECHNICAL INVESTIGATION

Geotechnical Assessment for Proposed Sanitary Sewer Upgrade Bralorne, BC

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November 25, 2016
File No. 016-065

Table of Contents

1 Introduction

As requested by TRUE Consulting Ltd. (TRUE), Westrek Geotechnical Services Ltd. (Westrek) carried out a geotechnical assessment for the proposed sanitary system for Bralorne Townsites #1 and #2 located in BC. This report includes the background information, site conditions and recommendations for the design and construction of the proposed sanitary sewer.

The scope of the geotechnical assessment was outlined in our proposal (File No. 016-065) dated July 27, 2016. Our Client Services Agreement, which was signed by TRUE on September 14, 2016.

The services provided by Westrek are subject to the terms and conditions set out in the *Interpretation and Use of Study and Report and Limitations*, which is attached in Appendix 1 and incorporated herein by reference.

2 Site Description and Proposed Development

The town of Bralorne consists of Townsite No. 1 and 2, and are situated along the Lillooet-Pioneer Highway at about 13 km south of Gold Bridge, BC. The townsites are situated on the southwest-facing flank of the Cadwallader Creek valley, which flows northwest into the Hurley River. Townsite No. 1 and 2 lie at an approximate elevation of 1075 m and 1115 m, respectively. From there, the slope rises up to a plateau (elevation 1300 - 1400 m), and subsequently to a steep valley slope leading up to Bender Range, which has peaks that extend to elevation 2300 to 2550 m (Figure 1 in Appendix 2).

The Town of Bralorne was developed to support the historical gold mine activity in the vicinity. The adjacent Bralorne Gold Mine was in production between 1928 and 1971, and then reopened in 2010[1]. It was purchased by Avino Silver & Gold Mines Ltd. in 2014 and is currently in trial production. The mine extends below the Hurley River Road and Lillooet – Pioneer Highway intersection (below TH-03 and TH-04), and likely extends below Bralorne.

Townsite No. 1 is located at the top of a steep terrace slope that rises about 50 m from the Bralorne Gold Mine processing plant. Townsite No. 2 is about 500 m farther southeast and is located on a southwest-facing terrace. The surrounding slopes are generally steep, and covered with deciduous and coniferous trees. Streams or other open water bodies were not observed within the townsites.

The proposed sanitary system will be located within the existing road right-of-ways, and will replace the existing sanitary system, which is currently located in private property. The total length of the sewer will be approximately 2.7 km and the installation depth will generally be less than 3 m with a localized area extending to about 4 m. It is understood that the sewer will consist of PVC pipe and will be installed using temporary excavation and backfill techniques.

Adjacent to Townsite No. 1, septic tanks are proposed on the northeast side of the Hurley River Road bridge that crosses Cadwallader Creek (i.e. TH-01). Details of the proposed septic tanks were not yet available at the time this report was prepared.

[1] Based on historical information obtained from Avino Silver & Gold Mines Ltd. Website: www.avino.com/s/bralorne.asp (obtained on November 24, 2016)

3 Geological Setting

According to published surficial geology mapping[2], the townsites are underlain by continuous, compact sandy loamy till deposits that are likely underlain by shallow bedrock. Steep slopes were formed by the incision of the Cadwallader Creek into the till. Loose colluvium, originating from the till, is expected at the base of these slopes, and the colluvium is expected to be inter-tongued with coarse fluvial deposits associated with Cadwallader Creek. Since the mine entrance is located about half-way up the steep slope that extends between the Bralorne Gold Mine process plant and Townsite No. 1, shallow bedrock is expected to be encountered in this vicinity.

Published geologic mapping[3] indicates the in this area is sedimentary and metasedimentary rocks of the Triassic-aged Cadwallader Group, mainly argillite and siltstone with calcareous zones, and by amphibolite, diorite and gabbro associated with the Paleozoic-aged Bralorne Intrusions.

An old debris slide or debris flow, and resulting colluvial fan are mapped in the northeast of Townsite No. 2 and are shown on Figure 1.

4 Fieldwork

The drilling was completed on October 5 and 6, 2016. It consisted of fourteen test holes (TH-01, TH-03 to TH-15) and the installation of five standpipe piezometers. The drilling was completed using a truck-mounted drill rig equipped with solid-stem augers from Downrite Drilling Ltd. Minimum test hole depths were determined by TRUE. The drilling was supervised by Simon Gautschi, P.Geo. of Westrek. Standard Penetration Tests (SPT) were completed at 1.5 m intervals and Dynamic Cone Penetration Tests (DCPT) were completed in select test holes. Disturbed soil samples were obtained for laboratory testing purposes. Details of each test hole are provided in Table 4-1.

Table 4-1: Summary of Test Holes

Test Hole	Estimated Surface Elevation (m)	Depth (m)	Practical Drilling Refusal	Townsite No.	Road Name	Standpipe Piezometer Installation	DCPT or SPT
TH-01	1030	3.0	-	1	Hurley River Rd	Yes	DCPT & SPT
TH-03	1062	3.0	Yes	1	Hurley River Rd / Lillooet-Pioneer Hwy	Yes	SPT
TH-04	1073	1.8	Yes	1	Lillooet-Pioneer Hwy	-	-
TH-05	1083	2.1	Yes	1	Lillooet-Pioneer Hwy	-	-
TH-06	1084	3.5	-	1	Marmot Cres / Dirk Pl	Yes	SPT
TH-07	1075	3.5	-	1	Marmot Cres	-	DCPT & SPT
TH-08	1092	3.0	-	1	Lillooet-Pioneer Hwy	-	SPT
TH-09	1110	5.0	-	2	Hawke Ave / Whiting Ave	Yes	SPT
TH-10	1110	4.6	-	2	Lillooet-Pioneer Hwy	-	DCPT & SPT
TH-11	1126	3.0	-	2	Arastra Pl	-	-
TH-12	1115	3.5	-	2	Hawke Ave	-	SPT
TH-13	1111	3.0	-	2	Whiting Ave	-	DCPT & SPT
TH-14	1121	3.0	-	2	Lillooet-Pioneer Hwy	Yes	DCPT
TH-15	1121	3.0	-	2	Hawke Ave	-	DCPT

[2] Clague, J.J., R.J. Fulton, and J.M. Ryder. (1982): *Surficial geology, Vancouver Island and adjacent mainland British Columbia.* Geological Survey of Canada. Open File 837. Scale 1:1,000,000.

[3] Church, B.N., et al. (1988): *Geology of the Bralorne Map Area 92J/15*. Province of British Columbia. Ministry of Energy, Mines and Petroleum Resources. Open File Map 1988-3. Scale 1:50,000.

Test hole surface elevations provided in Table 4-1 were estimated from topographic elevation contours provided on TRUE Consulting drawing titled *Bore-hole Reference* (Drawing No. 649-015 Fig 1 and Fig 2), dated September 2016.

Standpipe piezometers (i.e. 25 mm diameter PVC) were installed in five test holes and consisted of a 1.5 m long slotted section of pipe backfilled with sand. Above the slotted section, solid pipe was installed and consisted of sand backfill capped with bentonite. Other test holes were backfilled with drill cuttings.

Prior to commencing the drilling, the initial test hole locations were selected by Westrek and TRUE, a BC One Call was submitted and the underground utilities were located by Locates Unlimited. Due to utility conflicts, some of the test hole locations were adjusted in the field. Test hole TH-02 could not be completed because the road was too narrow to accommodate the ongoing mine traffic and drilling equipment. This decision to eliminate TH-02 was discussed and approved by TRUE during the fieldwork.

The approximate location of the test holes were recorded in the field using a handheld GPS device, and are indicated in the attached site plans (refer to Figures 2 and 3 in Appendix 2). The test hole logs, which includes a description of the observed subsurface conditions, are provided in Appendix 3 of this report.

Geotechnical laboratory testing was carried out and consisted of moisture content, Atterberg limits and particle size distribution testing on select soil samples. The Atterberg limits test was used to confirm the plasticity of the cohesive soil found in TH-06 and the results are included on the soil logs. The particle size distribution testing was used to confirm the gradation of the granular deposits and the results are attached in Appendix 4.

5 Subsurface Conditions

5.1 Soil Conditions

Based on the geological setting and site history, the subsurface conditions can be expected to vary considerably at the site and even within short distances from test holes. The design engineer and contractor should anticipate this when planning and tendering the project, and the contractor may need to carry out additional investigation when submitting a tender.

For the purposes of preparing this report, some assumptions regarding the subsurface conditions were made to assess the subsurface soils conditions and provide recommendations. These assumptions should not be solely relied upon for construction purposes.

5.1.1 Townsite No. 1

In general, the subsurface conditions within Townsite No. 1 encountered granular deposits with areas of low to medium plastic cohesive soils in the southeast (TH-06 and TH-08), and deep fill areas in the south portion (TH-05 and TH-08). Three of the seven test holes encountered practical drilling refusal, which is likely from bedrock, but could also be from the presence of boulders in the granular deposits. Due to the variability of these subsurface conditions and the limited number of test holes allotted for this townsite, the descriptions below should be considered as approximate.

Septic Tanks (TH-01):

- compact to very loose (with depth) sand and gravel with some cobbles to 1.8 m.
- loose gravelly sand with a few cobbles to 3.0 m.
- sloughing conditions were encountered during the drilling in this area.

North section of Lillooet-Pioneer Highway (TH-03 and TH-04):

- loose to compact granular deposits ranging from gravelly sand to gravel and cobbles were encountered within both test holes.
- in TH-03, granular deposit became compact to dense at 1.5 m.
- practical drilling refusal was encountered at 3 m in TH-03 and 1.8 m in TH-04.

South section of Lillooet-Pioneer Highway (TH-05 and TH-08):

- loose to compact fill consisting of sand with some gravel to sand and gravel to 0.6 m, which was likely the adjacent road pavement structure.
- in TH-05, loose to compact sand some gravel fill extended below the inferred pavement structure extended to a depth of 2.1 m.
- in TH-08, a layer of fill, consisting of silty, low plastic clay with some sand and a trace of gravel, below the inferred pavement structure extended to a depth of 1.5 m.
- below the clay fill (TH-08), loose sand and silt fill with some gravel extended to a 3 m depth.

Marmot Crescent (TH-06 and TH-07):

- a 0.3 m thick layer of compact to dense fill consisting of gravelly sand to gravel and sand was encountered, which was inferred to be the adjacent pavement structure.
- south section (TH-06), very stiff to hard, low to medium plastic clay extended to 3.0 m.
- north section (TH-07), loose to compact silty sand with some gravel, trace clay and a few cobbles extended to 3.5 m.

5.1.2 Townsite No. 2

The subsurface conditions within Townsite No. 2 were more consistent than Townsite No. 1. Within all of the test holes, except TH-11, the subsurface conditions consisted of near surface fills underlain by a finer-grained granular layer and then a coarse-grained granular layer.

Townsite No. 2 (excluding TH-11):

- fills, consisting of compact gravelly sand to gravel/sand, extended to depths of 0.3 to 0.9 m, which were inferred to be the road pavement structure or possibly subgrade fill.
- finer grained granular soils, consisting of loose to compact, sand and silt to sand with some gravel some silt, ranged in thickness from 0.3 m to over 2.4 m.
- excluding TH-12, coarser-grained granular soils, consisting of compact gravelly sand to gravel and sand with a few cobbles, extended to the end depth of the test holes.
- a distinctive interlayering of these deposits was sometimes observed near the transition.

Near the Hawkes Avenue and Whiting Avenue intersection (TH-09):

- firm to stiff, low plastic clay with a trace to some gravel extended below the inferred road pavement structure to a depth of 2.1 m.
- a 0.6 m layer of compact sand and gravel was present over the glacio-fluvial deposits observed within this townsite.

Near the Arastra Place cul-de-sac (TH-11):

- is higher in elevation than the adjacent test holes.
- compact gravelly, silty sand with some cobbles extended to a depth of 3 m (end of test hole) and is inferred to be the colluvial fan mentioned in Section 3.
- glacio-fluvial deposits are likely located at an unknown depth below end of the test hole, and likely decreases in thickness towards the Arastra Place and Lillooet-Pioneer Highway intersection.

In the southeast section of Whiting Avenue (TH-13):

- fill, consisting of loose to compact gravel and sand, extended to a depth of 2.1 m, and it is uncertain if this fill is localized or extends further from the test hole.
- compact gravel and sand extended to a depth of 3 m and is likely the coarse grained glacio-fluvial deposit.

5.2 Groundwater Conditions

Standpipe piezometers were installed in five of the fourteen test holes completed. Since the deposits were generally free-draining, the groundwater conditions were first measured after the test hole completion, and then re-measured in the afternoon of the day of demobilizing from the site. The standpipe piezometer details and groundwater conditions are provided in Table 5-1.

Table 5-1: Summary of Groundwater Conditions

Test Hole	Estimated Surface Elevation* (m)	Standpipe Installation Depth (m)	Standpipe Bottom Elevation (m)	Groundwater Level Upon Drilling Completion (m)	Groundwater Level On October 6 between 1 PM and 2 PM (m)
TH-01	1030	3.0	1027.0	Dry	Dry
TH-03	1062	2.9	1059.1	Dry	Dry
TH-06	1084	3.4	1080.6	Dry	Dry
TH-09	1110	4.6	1105.4	Seepage at 4.3	Dry
TH-14	1121	3.0	1118.0	Dry	Dry
Note: * Estimated from topographic elevation contours provided on TRUE Consulting drawing titled “Bore-hole Reference” (Drawing No. 649-015 Fig 1 and Fig 2), dated September 2016.					

Upon drilling completion of TH-09, groundwater seepage was observed at a depth of 4.3 m, which is just below the sandy silt layer, and there is a potential for capillary rise of groundwater into the sandy silt. In TH-13, groundwater seepage was noted at a depth of 2.4 m immediately after drilling, but due to site constraints a standpipe piezometer was not installed. Due to the coarse-grained nature of the TH-13 soils, capillary rise will not likely be significant.

Due to the free-draining properties of a majority of the subsurface soils, some groundwater fluctuations are anticipated from seasonal variations and precipitation events. It is recommended that the groundwater levels be re-measured prior to construction, so additional measures, if any, can be considered.

6 Assessment and Recommendations

6.1 Geotechnical Feasibility

The subsurface soil conditions summarized for Townsite No. 1 are consistent with the surficial geology described in Section 3. However, due to the interlayered subsurface soil conditions observed in Townsite No. 2, it is likely that the deposits are glacio-fluvial.

Based on the encountered subsurface conditions, it is our opinion that the proposed sanitary sewer construction is geotechnically feasible. The geotechnical recommendations provided in this report will cover a majority of the proposed sanitary sewer installation. However, there are some areas that may create some issues for the design and/or construction of the sewer, and may require further assessment by Westrek to provide area-specific recommendations during construction.

1. Since the town was built on mining property, there is likely to be uncontrolled fills throughout the area, and this will have to be addressed during construction or with additional geotechnical investigation, depending on the client's risk tolerance.
2. In the area of the proposed septic tanks (TH-01), the following should be considered:
    a. Depending on the distance from the steep terrace slope toe to the temporary excavation for the septic tanks, there could be a temporary excavation stability concern and this should be assessed by Westrek prior to construction.
    b. If the base of the septic tank excavation is deeper than 3 m (depth of the test hole), there is a potential that non-favorable conditions could be exposed during construction and Westrek should be contacted to provide additional recommendations, as required, at the time of construction.
    c. Sloughing conditions from loose to very loose granular soils below a depth of 1.5 m could require flatter temporary excavation slopes to install the tanks.
    d. Large boulders within the granular deposit could create some minor difficulty for temporary excavation slope grading.
3. Practical drilling refusal along the north and mid-south sections of Lillooet-Pioneer Highway within Townsite No. 1 (TH-03 to TH-05), and may signify depth to bedrock or the presence of large boulders, which may have the following negative impacts:
    a. At TH-03 refusal was encountered at a depth of about 3 m and since the pipe invert is generally above 3 m there, it will have limited impact on the proposed sewer installation.
    b. In the area of TH-04 and TH-05, refusal was encountered at a depth of about 1.8 to 2.1 m and is likely due to bedrock. This will likely require the sewer to be installed at a shallower depth and requiring insulation (refer to Section 6.2). It should be noted that the area below Townsite No. 1 is an active below-grade mine, and bedrock excavation (i.e. chipping or blasting) is not recommended, unless approved by the mine's engineer.

4. Along the south section of the Lillooet-Pioneer Highway within Townsite No. 1, test holes TH-05 and TH-08 encountered deep fills that were 2.1 and 3.0 m thick, respectively. In comparing the fill observed in the two test holes, the fill along this section of the highway is anticipated to be variable and may require additional recommendations during construction (i.e. flatter excavation slopes, temporary shoring or subgrade improvement below pipe).
5. A section of the Lillooet-Pioneer Highway, which connects the two townsite together, is located at the top of the Cadwallader Creek valley slope, and was not assessed in our geotechnical assessment. To reduce the potential for problems with the sanitary sewer main installation, the sewer should be installed on the cut slope (north) side of the road. In addition, it is recommended that the slope stability of this section of road be confirmed by completing a slope stability assessment, which will likely require deeper test holes.
6. Near the intersection of Hawkes Avenue and Whiting Avenue (TH-09), a groundwater level in the sandy silt was observed at 4.3 m, and is about 0.3 m lower than the deepest pipe invert depth. However, groundwater fluctuation and/or capillary rise in the sandy silt could create some construction difficulty for pipe installations and backfill compaction in this area. If required, some construction recommendations (i.e. dewatering or flatter slopes) may be required at the time of construction.
7. Along Whiting Avenue, which is in the south portion of Townsite No. 2, test hole TH-13 encountered the following conditions:
    a. Loose granular fill, which could also be variable, may require flatter temporary excavation slopes or shoring during construction.
    b. Groundwater level of 2.4 m was observed and could have an impact on the temporary excavation if the proposed pipe invert is at a depth approaching or below 2.4 m.

6.2 Frost Depth

Based on available literature[4], Bralorne area climate and generally granular soils encountered in both townsites, the estimated depth of frost penetration is about 1.9 m below finished road subgrade. It is recommended that the sanitary sewer (including septic tanks) be installed such that the top of pipe is provided with at least 1.9 m of soil cover. In areas where a minimum frost cover of 1.9 m of cover cannot be provided and specific details of each area are made available, Westrek should be contacted to provide additional recommendations for rigid extruded polystyrene insulation.

Considering the observed groundwater seepage and measured groundwater levels, it is anticipated that frost penetration will not likely overlap the groundwater level; thus, the potential for frost heave near the depth of the proposed sanitary sewer will be low.

6.3 Temporary Excavations

Most of the temporary excavations will extend to a 3 m depth, with some extending to 4 m in the northwest portion of Townsite No. 2 (TH-09 and TH-10).

As a minimum requirement, all temporary excavations must satisfy Part 20 (Excavation Section) of the WorkSafeBC *Occupational Health and Safety Regulation*. Potentially problematic areas, which may require flatter slopes, temporary dewatering and/or shoring, are indicated in Table 6-1. Since the

[4] University of British Columbia (2014): ClimateBC_Map (www.climatewna.com/climateBC_Map.aspx)

Bralorne area is located on mining property, fills in areas not indicated in the table below could be expected. To satisfy this requirement, the contractor may need to retain a geotechnical engineer to design and monitor any temporary excavations and provide recommendations as required.

Table 6-1: Potentially Problematic Areas for Temporary Excavation

Approximate Areas	Potential Condition
Townsite No. 1 - septic tank area (TH-01)	• Loose to very loose deposit ranging from sand to sand / gravel. • Near the toe of a steep terrace slope.
Townsite No. 1 - south portion of Lillooet-Pioneer Highway (TH-05 and TH-08)	• Significant fill depth consisting of sand/gravels, silts and clays
Townsite No. 2 – intersection of Hawkes Avenue and Whiting Avenue (TH-09)	• Fills extending at least 1 m. • Groundwater seepage was observed at 4.3 m and some capillary rise could occur and may require dewatering.
Townsite No. 2 - Whiting Avenue area (TH-13)	• Significant fill depth consisting of sand/gravels, silts and clays • Groundwater seepage was observed at 2.4 m.
Adjacent / crossing existing utilities	• Significant fill depth.

Given the nature of the deposits and the surface boulders observed in the Bralorne area, large boulders could be encountered during temporary trench excavation, and may require a wider trench and additional excavation time to complete.

In some of the areas, there is a possibility of fill, which is likely uncontrolled, being encountered at the pipe bedding depth. If fill is encountered, it should be reviewed by Westrek to confirm that the fill is suitable for pipe installation and trench backfill. If the fill is unsuitable, it should be sub-excavated and re-compacted as an engineered fill (refer to Section 6.4).

6.4 Trench Backfill

It is recommended that a minimum 300 mm thickness of bedding sand material be provided below the sanitary sewer pipe and a minimum 300 mm surround sand material be provided above the pipe. The pipe bedding and surround sand materials should meet the applicable specifications required by the Squamish-Lillooet Regional District and/or BC Ministry of Transportation and Infrastructure (BC MoTI). Bedding materials should be moisture conditioned to near optimum moisture content and compacted to 95 percent of the material's Standard Proctor Maximum Dry Density (SPMDD), with reference to ASTM D698.

Trench backfill above the surround material could consider the re-use of excavated material including inorganic sand and gravel, silt and clay soils. Within 0.5 m above the pipe surround, the trench backfill particle size should be limited to 75 mm, and the particle size should be limited to 150 mm above this zone. Import of suitable backfill material may be required if excavated trench material contains a significant amount of oversize material. Trench backfill should be moisture conditioned to near optimum moisture content and compacted to 95 percent of the material's SPMDD. Within 0.3 m of proposed road subgrade, the trench backfill should be compacted to 100 percent of the material's SPMDD. Appropriate compaction equipment should be selected that will not damage the pipe and the lift thickness should be appropriate for the compaction equipment. Since most of the trench backfill will be located below roadways, the material should be uniformly compacted.

6.5 Road Surface Restoration

It appears that the existing residential roads located in Bralorne consist of asphalt-surfaced and gravel-surfaced roads, which are subjected to relatively low traffic volumes consisting of light duty vehicles with occasional heavy duty vehicles. With reference to the BC MoTI Technical Circular Pavement Structure Design Guidelines (T-01/15, dated January 26, 2015), it is anticipated that the residential roads within the site area are anticipated to be Type C and/or Type D roads with a 20 year design Equivalent Single-Axle Loads of less than 100,000. The minimum pavement structures provided below are based on this road classification assumption, which should be confirmed by TRUE. If there is a potential for mining related truck traffic, the minimum pavement sections might not be sufficient and additional assessment may be required.

Rather than limiting the road surface reconstruction to areas where the trench excavation occurred, it may be more favorable to reconstruct the entire road width to provide a consistent pavement structure, which will reduce differential movements of the road surface. If the entire road width is to be constructed, the existing subgrade should be prepared to meet the Roadway and Drainage Excavation specifications provided in Section 201 of the BC MoTI 2016 Standard Specifications for Highway Construction (Standard Specifications). Proof-roll testing, which may require additional subgrade preparation, should be completed over the areas where road surface restoration is proposed. Above approved subgrade and trench backfill, the minimum pavement structures (Tables 6-2 and 6-3), which are based on typical CBR values for clay and granular subgrade, can be considered to reinstate the road surface.

Table 6-2: Minimum Pavement Structures Over Clay Subgrade

Material	Asphalt-Surface Pavement Structure	Granular-Surface Pavement Structure
Asphalt (AP)	50 mm	-
High Fines Granular Surfacing Aggregate	-	150 mm
Crushed Base Course (CBC)	225 mm	225 mm
Select Granular Sub-Base (SGSB)	300 mm	300 mm
Minimum Cross-Slope / Crown	2 percent	3 percent

Table 6-3: Minimum Pavement Structures Over Granular Subgrade

Material	Asphalt-Surface Pavement Structure	Granular-Surface Pavement Structure
Asphalt (AP)	50 mm	N/A
High Fines Granular Surfacing Aggregate	N/A	150 mm
Crushed Base Course (CBC)	225 mm	225 mm
Select Granular Sub-Base (SGSB)	150 mm	150 mm
Minimum Cross-Slope / Crown	2 percent	3 percent

The Crushed Base Course aggregate should consist of 25 mm Well Graded Base material and the Select Granular Sub-Base aggregate should consist of SGSB material, as outlined in the BC MoTI Standard Specifications Table 202-C "Aggregate Gradations". The placement and compaction of these materials should follow BC MoTI Standard Specifications Section 202 "Granular Surfacing, Base and Sub-Bases," and will generally require the materials to compacted to 100 percent of the materials' SPMDD.

Where High Fines Granular Surfacing Aggregate is required, the material and placement should meet the specifications provided in BC MoTI Standard Specifications Section 202 "Granular Surfacing, Base and Sub-Bases".

Where Asphalt Pavement is proposed, the material and placement should meet the specifications provided in BC MoTI Standard Specification Section 502 "Asphalt Pavement Construction (EPS)".

The pavement structure, including underlying Crushed Base Course and Select Granular Sub-Base, should be constructed to provide the minimum cross-slope / crown.

7 Construction Review

Westrek must be retained by the owner during the sanitary sewer construction to:

- Be the geotechnical consultant representing and providing advice to the owner during construction;
- Provide site-specific recommendations for areas that contain fills and where shallow test hole refusal was encountered; and
- Provide review and/or conduct additional investigation and assessment for the septic tank (including temporary excavation) near TH-01.

The contractor should retain a quality control testing firm and/or a geotechnical engineer to:

- Review and monitor temporary excavations deeper than 1.2 m;
- Review trench backfill and pipe bedding/surround and conduct compaction testing;
- Review and proof-roll final road subgrade;
- Provide compaction testing on base and subbase materials; and
- Provide asphalt testing.

8 Closure

Please contact the undersigned if there are any questions.

Westrek Geotechnical Services Ltd.

Per:

David Lang, P.Eng
Geotechnical Engineer

Reviewed by:

Kevin Turner, P.Eng
Senior Geotechnical Engineer

APPENDIX 1

INTERPRETATION AND USE OF STUDY AND REPORT AND LIMITATIONS

1. STANDARD OF CARE.

This study and Report have been prepared in accordance with generally accepted engineering and geoscience practices. No other warranty, express or implied, is made. Geological and geotechnical studies and reports do not include environmental consulting unless specifically stated in the report.

2. COMPLETE REPORT.

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF THE REPORT.

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT.

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorise only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell or otherwise make the Report or any portion thereof, available to any party without our written permission. Any uses, which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. Westrek accepts no responsibility for damages suffered by any third party resulting from unauthorised use of the Report.

5. INTERPRETATION OF THE REPORT.

(i) Nature and Exactness of Soil and Description: Classification and identification of soils, rocks, geological units, and engineering estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilising the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(ii) Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations or fraudulent acts of any persons providing representations, information and instructions.

(iii) To avoid misunderstandings, Westrek should be retained to work with the other design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to engineering issues. Further, Westrek should be retained to provide field reviews during the construction, consistent with generally accepted practices.

6. LIMITATIONS OF LIABILITY.

Westrek's liability will be limited as follows:

(a) In recognition of the relative risks and benefits of the Services to be provided to the Client by Westrek, the risks have been allocated such that the Client agrees, to the fullest extent permitted by law, to limit the liability of Westrek, its officers, directors, partners, employees, shareholders, owners, subconsultants and principals for any and all claims, losses, costs, damages of any nature whatsoever or claims expenses from any cause or causes, whether arising in contract or tort including negligence, including legal fees and costs and disbursements (the "Claim"), so that the total aggregate liability of Westrek, its officers, directors, partners, employees, shareholders, owners, subconsultants and principals:

i. if the Claim is satisfied by the re-performance of the Services proven to be in error, shall not exceed and shall be limited to the cost to Westrek in re-performing such Services; or

ii. if the Claim cannot be satisfied by the re-performance of the Services and:

1. if Westrek's professional liability insurance does not apply to the Claim, shall not exceed and shall be limited to Westrek's total fee for services rendered for this matter, whichever is the lesser amount. The Client will indemnify and hold harmless Westrek from third party Claims that exceed such amount; or

2. if Westrek's professional liability insurance applies to the Claim, shall be limited to the coverage amount available under Westrek's professional liability insurance at the time of the Claim. The Client will indemnify and hold harmless Westrek from third party Claims that exceed such coverage amount. Westrek shall maintain professional liability insurance in the amount of $2,000,000 per occurrence, $2,000,000 in the aggregate, for a period of two (2) years from the date of substantial performance of the Services or earlier termination of this Agreement. If the Client wishes to increase the amount of such insurance coverage or duration of such policy or obtain other special or increased insurance coverage, Westrek will cooperate with the Client to obtain such coverage at the Client's expense.

It is intended that this limitation will apply to any and all liability or cause of action however alleged or arising, including negligence, unless otherwise prohibited by law. Notwithstanding the foregoing, it is expressly agreed that there shall be no claim whatsoever against Westrek, its officers, directors, partners, employees, shareholders, owners, subconsultants and principals for loss of income, profit or other consequential damages howsoever arising, including negligence, liability being limited to direct damages.

(b) Westrek is not responsible for any errors, omissions, mistakes or inaccuracies contained in information provided by the Client, including but not limited to the location of underground or buried services, and with respect to such information, Westrek may rely on it without having to verify or test that information. Further, Westrek is not responsible for any errors or omissions committed by persons, consultants or specialists retained directly by the Client and with respect to any information, documents or opinions provided by such persons, consultants or specialists, Westrek may rely on such information, documents or opinions without having to verify or test the same.

(c) Notwithstanding the provisions of the Limitation Act, R.S.B.C. 2012 c. 13, amendments thereto, or new legislation enacted in its place, Westrek's liability for any and all claims, including a Claim as defined herein, of the Client or any third party shall absolutely cease to exist after a period of two (2) years following the date of:

i. Substantial performance of the Services,

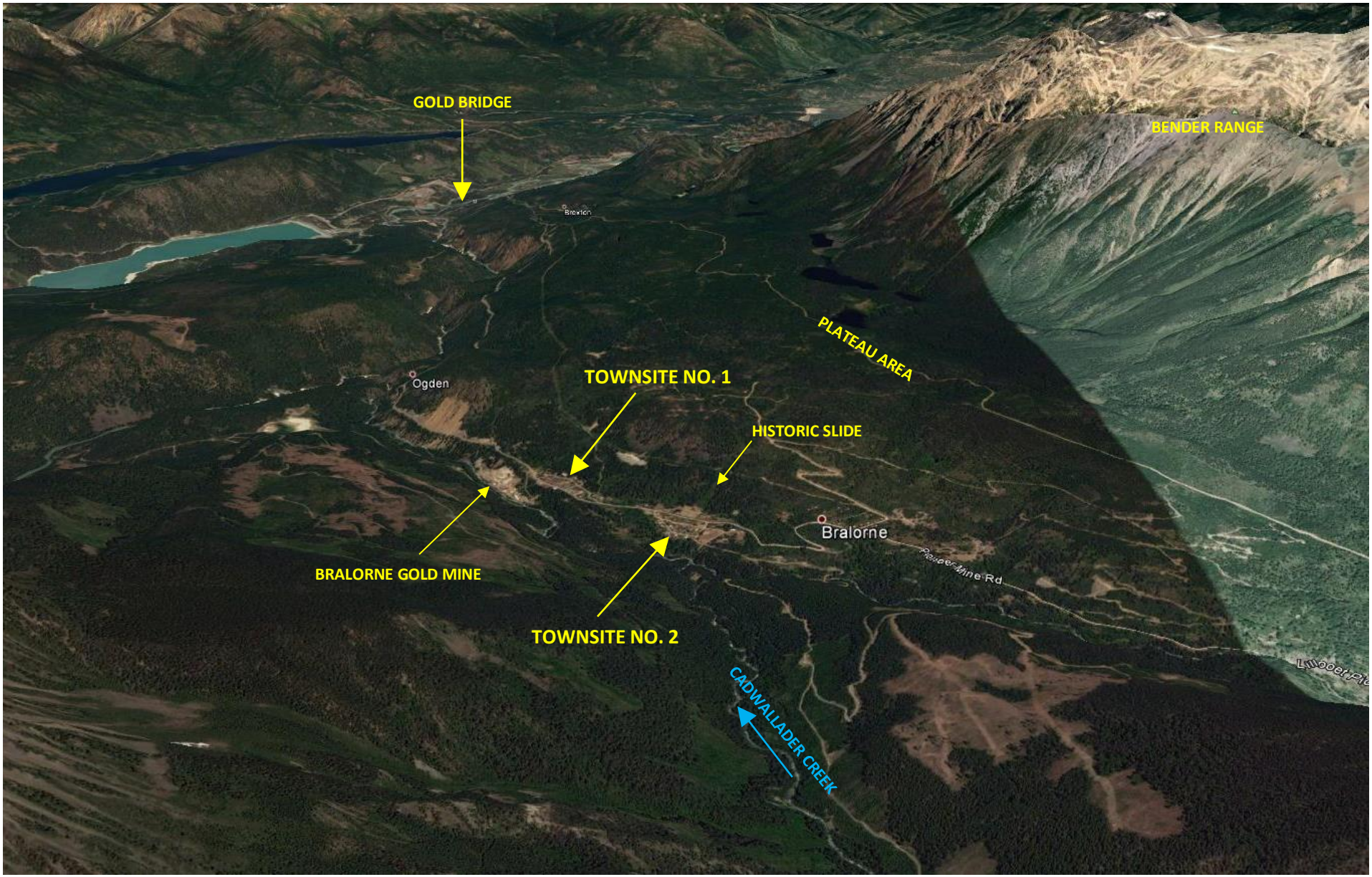
ii. Suspension or abandonment of the Services provided under this agreement, or

iii. Termination of Westrek's Services under the agreement,

whichever shall occur first, and following such period, the Client shall have no claim, including a Claim as defined herein, whatsoever against Westrek.

APPENDIX 2

Site Plans



LOOKING NORTH

WESTREK Geotechnical Services Ltd.	**SITE LOCATION MAP** **BRALORNE TOWNSITES**	Scale: NTS Date: 2016-11-25	**FIGURE 1**
	Source: Google™ Earth	Project: 016-065	

ALL BUILDING LOCATIONS APPROXIMATE

#1
#2
#3
#4
#5
#6

TH-01
TH-03
TH-04
TH-05
TH-06
TH-07
TH-08

MARMOT CRES
CUNNINGHAM PLACE
DIRK PLACE
LILLOOET - PIONEER HIGHWAY
HURLEY RIVER ROAD
ROAD R/W KAP 57325
CADWALLADER CREEK

DL 671
WOOD DUCK M.C.

DL 670
TELEPHONE M.C.

EX SEPTIC TANK

EXISTING
MECH. SHOP

EX OUTFALL
(LOCATION APPROX)

EXISTING MINE MILL
BUILDING (LOCATION APPROX)

EX EMERGENCY TAILINGS POND
(LOCATION APPROX)

BRALORNE GOLD MINES LTD. BUILDINGS
(SCHEMATIC) OFFICES AND STAFF
ACCOMODATION (LOCATION APPROX)

EXISTING BRIDGE
(LOCATION APPROX)

LEGEND

- POWER POLE
- LIGHT STANDARD
- IRON PIN
- CURB STOP
- GEOTECHNICAL TEST HOLE
- VALVE
- HYDRANT
- SANITARY MANHOLE FOUND
- SANITARY MANHOLE ASSUMED
- CLEANOUT
- WATER
- EX SANITARY TO BE ABANDONED
- EX SANITARY TO REMAIN IN SERVICE
- TRESPASS AREA

WESTREK Geotechnical Services Ltd.

Scale: NTS

Date: 2016-11-15

Project: 016-065

SITE PLAN SHOWING
TOWNSITE #1 – TEST HOLE LOCATIONS

Base map: TRUE Consulting. Drawing No.: FIG.3 649-012

FIGURE 2

ALL BUILDING LOCATIONS APPROXIMATE

LOT 5485
MACK FRACTION M.C.

LOT 5484
POLNUD M.C.

LOT 5484

ARASTRA PLACE

HAWKE AVE

LORNE STREET

WHITING AVE

LILLOOET - PIONEER HIGHWAY

PLAN A7319

REM 20
25011

REM 20
25011

A
47361

A
B6958

#7 #8 #9 #10 #11 #12 #13 #14 #15

TH-09 TH-10 TH-11 TH-12 TH-13 TH-14 TH-15

SEPTIC TANK
(LOCATION APPROX)

OUTFALL
(LOCATION APPROX)

CADWALLADER CREEK

LEGEND

- POWER POLE
- LIGHT STANDARD
- IRON PIN
- CURB STOP
- GEOTECHNICAL TEST HOLE
- VALVE
- HYDRANT
- SANITARY MANHOLE FOUND
- SANITARY MANHOLE ASSUMED
- CLEANOUT
- WATER
- EX SANITARY TO BE ABANDONED
- EX SANITARY TO REMAIN IN SERVICE
- TRESPASS AREA

WESTREK
Geotechnical Services Ltd.

Scale: NTS

Date: 2016-11-15

Project: 016-065

SITE PLAN SHOWING
TOWNSITE #2 – TEST HOLE LOCATIONS

Base map: TRUE Consulting. Drawing No.: FIG.4 649-012

FIGURE 3

APPENDIX 3

Test Hole Logs

BOREHOLE TH-01
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 06-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 512747E 5624935N
Elevation: 1030 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY
INSTALLATION: GROUT | BENTONITE | SAND | DRILL CUTTINGS | SCREEN

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0	Solid-stem auger	SAND and GRAVEL (sub-angular), some cobbles, trace silt; compact; brown-grey; damp.				1		W_n = 4.5%		1029
1		... becomes loose to very loose.		1.5 (1028.5)						
		SAND, silty, gravelly, few cobbles; loose; brown-grey; moist.		1.8 (1028.2)		1		N = 7		
2		... possibly large (+1 m diameter) boulders in this layer.		2.5 (1027.5)		2		W_n = 18.6%		1028
3		End of hole at 3 m (1027 m) Notes: Sloughing noted. Standpipe dry on October 6, 2016 at 2:00 PM.								1027
4										1026
5										1025
6										

PLASTIC / M.C. / LIQUID: 10 20 30 40
N - BLOW COUNT [SPT] ◆ [DCPT] ▼: 10 20 30 40
VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗: 40 80 120 160

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

BOREHOLE TH-03
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 06-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 512677E 5625254N
Elevation: 1062 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY
INSTALLATION: GROUT | BENTONITE | SAND | DRILL CUTTINGS | SCREEN

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0	Solid-stem auger	SAND, gravelly (angular), some silt, compact, brown-grey, damp				1		W_n = 3.1%		1061
1		SAND, silty, trace gravel, compact, light brown-grey, damp		1.2 (1060.8)		2		W_n = 6.9%		
		GRAVEL and COBBLES (sub-angular), some sand, trace silt, compact to dense		1.5 (1060.5)		1		>>◆N = 63		1060
2						3		W_n = 3.4%		
3		End of hole at 3 m (1059 m) Notes: Pratical drilling refusal at 3 m. Standpipe dry on October 6, 2016 at 2:00 PM.								1059
4										1058
5										1057
6										

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

BOREHOLE TH-04
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling

Project No.: 016-065
Co-ordinate: 10 U 512786E 5625063N
Elevation: 1073 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Solid-stem auger	SAND and GRAVEL (sub-angular), trace silt, loose to compact, brown-grey, damp				1	PLASTIC M.C. LIQUID 10 20 30 40; N - BLOW COUNT [SPT] ◆ [DCPT] ▼ 10 20 30 40; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗ 40 80 120 160	W_n = 4.9%	
1		GRAVEL and COBBLES, very hard drilling. ... No recovery.		0.9 (1072.1)		2			1072
2		End of hole at 1.8 m (1071.2 m) Notes: Pratical drilling refusal at 1.8 m. Backfilled with drill cuttings. Groundwater seepage was not observed.							1071
3									1070
4									1069
5									1068
6									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

BOREHOLE TH-05
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling

Project No.: 016-065
Co-ordinate: 10 U 512939E 5624880N
Elevation: 1083 m [Estimated]

SAMPLE TYPE: ☒ SPT SAMPLE | ▤ GRAB SAMPLE | ▥ SHELBY TUBE | ▮ CORE SAMPLE | ■ NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Solid-stem auger	SAND and GRAVEL (FILL), silty, loose to compact, brown-grey, moist					PLASTIC M.C. LIQUID: 10 20 30 40; N - BLOW COUNT [SPT] ◆ [DCPT] ▼: 10 20 30 40; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗: 40 80 120 160		
				0.6 (1082.4)					
1		SAND (FILL), some gravel (sub-angular), trace silt, loose to compact, brown-grey, damp				1		W_n = 4.9%	1082
		... hard drilling, potential for boulders and increased cobbles		1.5 (1081.5)					
2									1081
		End of hole at 2.1 m (1080.9 m) Notes: Pratical drilling refusal at 2.1 m. Backfilled with drill cuttings. Groundwater seepage was not observed.							
3									1080
4									1079
5									1078
6									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

BOREHOLE TH-06
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 06-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 512931E 5625027N
Elevation: 1084 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY
INSTALLATION: GROUT | BENTONITE | SAND | DRILL CUTTINGS | SCREEN

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0	Solid-stem auger	Gravelly SAND (FILL), trace silt, compact, brown-grey, damp		0.3 (1083.7)						
1		CLAY, silty, low to medium plastic, trace gravel (sub-angular), very stiff to hard, light-brown grey, damp, trace oxides				1		W_n = 14.0% PL = 17.1% LL = 30.2%		1083
2		... low plastic, some gravel, trace cobbles, moist		1.8 (1082.2)		1		N = 34		1082
		... layers of silt and silty sand, moist		2.4 (1081.6)		2		W_n = 21.6%		
3		... becoming stiff		3 (1081)		2		N = 17 W_n = 19.2%		1081
		End of hole at 3.5 m (1080.5 m) Notes: Standpipe dry on October 6, 2016 at 1:00 PM.								
4										1080
5										1079
6										

PLASTIC / M.C. / LIQUID: 10 20 30 40
N - BLOW COUNT [SPT] ◆ [DCPT] ▼: 10 20 30 40
VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗: 40 80 120 160

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

WESTREK Geotechnical Services Ltd.

BOREHOLE TH-07
Bralorne Sanitary Sewer Upgrade

Date Drilled: Oct 06-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 512765E 5625173N
Elevation: 1075 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Solid-stem auger	GRAVEL and SAND (FILL), angular, trace silt, compact to dense, grey, moist		0.3 (1074.7)					
		SAND, silty, some gravel (sub-angular), trace clay, few cobbles, compact, light grey-brown, damp ... becoming loose		0.6 (1074.4)		1		W_n = 9.6%	
1									1074
						1		N = 10	
2		... becoming compact		2.1 (1072.9)		2		W_n = 8.2%	1073
3						2		N = 16 W_n = 4.9%	1072
		End of hole at 3.5 m (1071.5 m) Notes: Backfilled with drill cuttings. Groundwater seepage was not observed.							
4									1071
5									1070
6									

PLASTIC / M.C. / LIQUID: 10 20 30 40
N - BLOW COUNT [SPT] ◆ [DCPT] ▼: 10 20 30 40
VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗: 40 80 120 160

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

BOREHOLE TH-08
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 513075E 5624769N
Elevation: 1092 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Solid-stem auger	SAND (FILL), some gravel, contains shale chips, compact, grey							
				0.6 (1091.4)					
		CLAY (FILL), silty, low plastic, some coarse sand, trace gravel (sub-angular), soft, brown-grey, damp				1	M.C. ○	W_n = 14.7%	
1									1091
				1.5 (1090.5)					
		SAND and silt (FILL), some gravel (sub-angular), trace clay, loose, grey, moist				1	N ◆	N = 5	
2									1090
						2	M.C. ○	W_n = 13.1%	
3		End of hole at 3 m (1089 m) Notes: Backfilled with drill cuttings. Groundwater seepage was not observed.				2	N ◆	N = 8	1089
4									1088
5									1087
6									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

BOREHOLE TH-09
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 513283E 5624613N
Elevation: 1110 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY
INSTALLATION: GROUT | BENTONITE | SAND | DRILL CUTTINGS | SCREEN

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m) Water Level
0	Solid-stem auger	SAND and GRAVEL (FILL), angular, some silt, compact, grey, damp								
1		CLAY, silty, low plastic, trace to some gravel, firm to stiff, damp, trace oxides, trace organics		0.9 (1109.1)		1		W_n = 12.1%		1109
						1		N = 9		
2		SAND and GRAVEL (angular to sub-rounded), silty, compact, grey, moist		2.1 (1107.9)		2		W_n = 7.7%		1108
		SAND and silt, trace to some gravel (angular to sub-rounded), trace clay, compact, light grey, moist to wet, trace oxides		2.7 (1107.3)						
3						2		N = 11		1107
						3		W_n = 13.3%		
4										1106
		GRAVEL (angular to sub-rounded) and SAND, trace to some silt, (some silt layers), compact, grey, wet, trace oxides		4.4 (1105.6)						
5						3		N = 22 W_n = 8.1%		1105
		End of hole at 5 m (1105 m) Notes: Groundwater was observed at 4.3 m after drilling. Standpipe was dry on October 6, 2016 at 1:00 PM.								
6										

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK
Geotechnical Services Ltd.

BOREHOLE TH-10
Bralorne Sanitary Sewer Upgrade

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling

Project No.: 016-065
Co-ordinate: 10 U 513251E 5624682N
Elevation: 1110 m [Estimated]

SAMPLE TYPE ☒ SPT SAMPLE ▤ GRAB SAMPLE ▥ SHELBY TUBE ◧ CORE SAMPLE ■ NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC M.C. LIQUID 10 20 30 40 / N - BLOW COUNT [SPT] ◆ [DCPT] ▼ 10 20 30 40 / VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗ 40 80 120 160	OTHER DATA	Elevation (m)
0	Solid-stem auger	SAND and GRAVEL (FILL), some silt, compact, grey, damp							
				0.6 (1109.4)					
1		SAND and silt, some gravel (sub-angular), trace clay, loose, brown-grey, moist, trace organics from 0.6 to 0.9 m							1109
		... becoming very loose		1.2 (1108.8)		1		W_n = 9.4%	
		SAND, gravelly, few cobbles, some silt, compact, grey, moist		1.5 (1108.5)		1		N = 24	
2									1108
						2		W_n = 6.2%	
3		... trace to some silt		3 (1107)		2		N = 23 W_n = 5.4%	1107
		... some cobbles (hard drilling, sloughing)		3.7 (1106.3)					
4						3		W_n = 7.2%	1106
		End of hole at 4.6 m (1105.4 m) Notes: Sloughing noted. Backfilled with drill cuttings. Groundwater seepage was not observed.							
5									1105
6									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK
Geotechnical Services Ltd.

BOREHOLE TH-11
Bralorne Sanitary Sewer Upgrade

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling

Project No.: 016-065
Co-ordinate: 10 U 513386E 5624670N
Elevation: 1126 m [Estimated]

SAMPLE TYPE: ☒ SPT SAMPLE ▤ GRAB SAMPLE ▥ SHELBY TUBE ◧ CORE SAMPLE ■ NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Solid-stem auger	Gravelly (angular to sub-rounded) silty SAND, trace clay, some cobbles, compact, brown-grey, damp					PLASTIC M.C. LIQUID: 10 20 30 40 N - BLOW COUNT [SPT] ◆ [DCPT] ▼: 10 20 30 40 VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗: 40 80 120 160		
1		... less cobbles from 1.5 m to 2.1 m		1.5 (1124.5)					1125
2						1	○	W_n = 7.0%	1124
3		End of hole at 3 m (1123 m) Notes: Backfilled with drill cuttings. Groundwater seepage was not observed.							1123
4									1122
5									1121
6									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

BOREHOLE TH-12
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 513352E 5624561N
Elevation: 1115 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Solid-stem auger	GRAVEL (angular) and SAND (FILL), silty, dense, grey, damp							
				0.6 (1114.4)					
1		SAND, silty, trace gravel, compact, grey, damp				1	M.C.	W_n = 11.4%	1114
				1.2 (1113.8)					
		INTERLAYERED silty SAND / SAND trace silt, trace gravel, loose, grey, moist				2	M.C.	W_n = 13.0%	
						1	N	N = 6	
2									1113
				2.1 (1112.9)					
		SAND (fine), some silt, loose, moist				3	M.C.	W_n = 12.2%	
3				3 (1112)					1112
		INTERLAYERED SAND and silt / SAND, trace gravel, loose, brown-grey, moist, trace oxides				1	N, M.C.	N = 9 W_n = 10.8%	
		End of hole at 3.5 m (1111.5 m) Notes: Backfilled with drill cuttings. Groundwater seepage was not observed.							
4									1111
5									1110
6									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

WESTREK Geotechnical Services Ltd.

BOREHOLE TH-13
Bralorne Sanitary Sewer Upgrade

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 513409E 5624427N
Elevation: 1111 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m) Water Level
0	Solid-stem auger	GRAVEL and SAND (FILL), silty, trace clay, occasional cobbles, compact, grey, moist					PLASTIC M.C. LIQUID: 10 20 30 40 N - BLOW COUNT [SPT] ◆ [DCPT] ▼: 10 20 30 40 VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗: 40 80 120 160		
		... becomes loose		0.6 (1110.4)		1		W_n = 8.8%	
1									1110
						1		N = 6	
2		GRAVEL (sub-angular to sub-rounded) and SAND, trace to some silt, occasional cobbles, compact, moist ... becomes wet at 2.4 m		2.1 (1108.9) 2.4 (1108.6)					1109
						2		W_n = 8.2%	
3		End of hole at 3 m (1108 m) Notes: Backfilled with drill cuttings. Groundwater observed at 2.4 m during drilling.							1108
4									1107
5									1106
6									

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

BOREHOLE TH-14
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 513439E 5624560N
Elevation: 1121 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY
INSTALLATION: GROUT | BENTONITE | SAND | DRILL CUTTINGS | SCREEN

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	SLOTTED PIEZOMETER	Elevation (m)
0	Solid-stem auger	SAND (FILL), gravelly, silty, compact, damp								
		... becomes loose		0.6 (1120.4)						
1		SAND, silty, some gravel (sub-rounded), loose, brown-grey, moist		0.9 (1120.1)						1120
		SAND, silty, some gravel (sub-angular to sub-rounded), compact, light grey, moist		1.2 (1119.8)		1		W_n = 8.7%		
		... gravelly, some cobbles		1.5 (1119.5)						
2		... trace clay, moist		2.1 (1118.9)		2		W_n = 8.8%		1119
		... gravelly		2.7 (1118.3)						
3		End of hole at 3 m (1118 m) Notes: Minor slough noted. Standpipe dry on October 6, 2016 at 2:00 PM.								1118
4										1117
5										1116
6										

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

BOREHOLE TH-15
Bralorne Sanitary Sewer Upgrade

WESTREK Geotechnical Services Ltd.

Date Drilled: Oct 05-2016
Drill Type: Truck Mounted
Driller: Downrite Drilling
Project No.: 016-065
Co-ordinate: 10 U 513530E 5624452N
Elevation: 1121 m [Estimated]

SAMPLE TYPE: SPT SAMPLE | GRAB SAMPLE | SHELBY TUBE | CORE SAMPLE | NO RECOVERY

Depth (m)	DRILLING METHOD	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m) (ELEV.)	SAMPLE TYPE	SAMPLE NO	PLASTIC / M.C. / LIQUID; N - BLOW COUNT [SPT] ◆ [DCPT] ▼; VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗	OTHER DATA	Elevation (m)
0	Solid-stem auger	SAND and GRAVEL (FILL), silty, compact, brown-grey, moist		0.3 (1120.7)					
		SAND, some gravel (fine angular to sub-rounded), some silt, compact, light brown (trace black specks), moist		0.6 (1120.4)					
1		SAND and GRAVEL (angular to sub-rounded), silty, some cobbles, light brown, moist ... becomes dense to very dense		0.9 (1120.1)		1	W_n = 7.8%		1120
2		... becomes dense		1.8 (1119.2)		2	W_n = 6.0%		1119
3		End of hole at 3 m (1118 m) Notes: Sloughing at 2.7 m. Backfilled with drill cuttings. Groundwater seepage was not observed.							1118
4									1117
5									1116
6									

PLASTIC / M.C. / LIQUID: 10 20 30 40
N - BLOW COUNT [SPT] ◆ [DCPT] ▼: 10 20 30 40
VANE SHEAR (kPa) [Rig] ✖ [Pocket] ⊗: 40 80 120 160

N - Blow Count
Standard Penetration Test [SPT]: ASTM D1586
Dynamic Cone Penetration Test [DCPT]: Number of blows using SPT energy to produce 300 mm of penetration of a 50 mm diameter cone.

LOGGED: SG
DRAWN: DL

WESTREK SOIL BOREHOLE LOG BRALORNE.GPJ WGS SOIL LOG.GDT 16-11-25

APPENDIX 4

Laboratory Test Results

SIEVE ANALYSIS REPORT

amec foster wheeler

Westrek Geotechnical Services Ltd
101- 1285 Dalhousie Drive
Kamloops, BC
V2C 5Z5

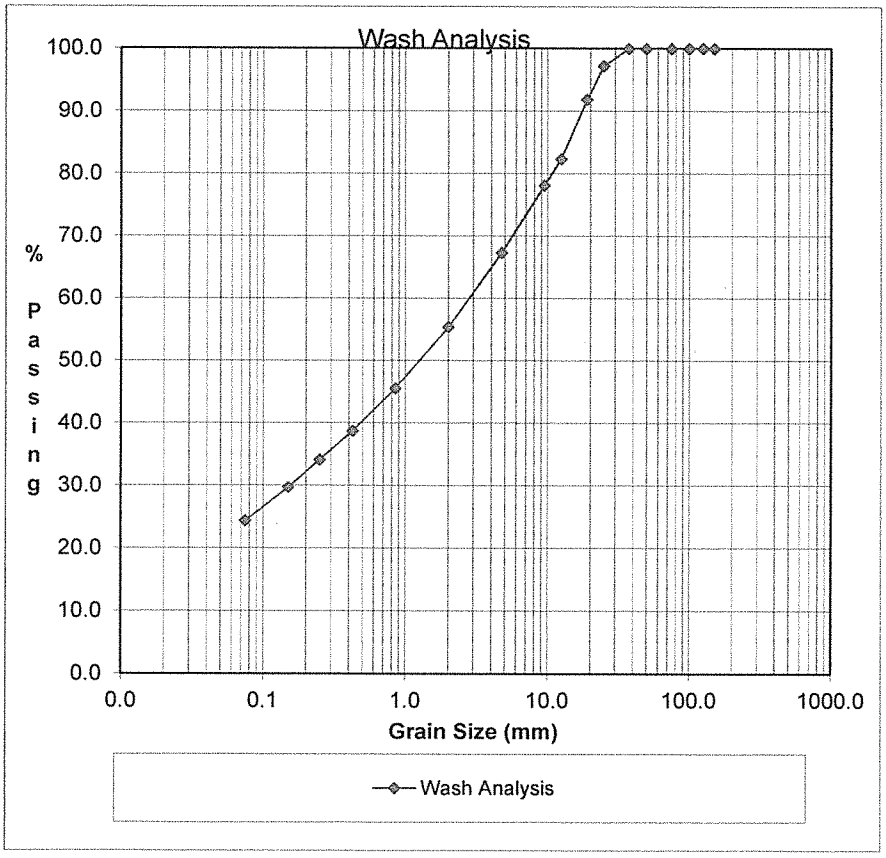
Project No:KX13690
Date: October 12, 2016

Attn: Simon Gautschi

Project Name: Bralorne Sewer

Test No.: 16-169-2 Source: TH-11 @ 3'-10' Sample Type: Bulk Sample

Date Sampled : October 7, 2016 By: Client Date Tested: October 12, 2016



Wash Sieve Analysis				
Sieve Size(mm)	Percent Retained	Percent Passing	Limits	
			Upper	Lower
150.0	0.0	100.0		
125.0	0.0	100.0		
100.0	0.0	100.0		
75.0	0.0	100.0		
50.0	0.0	100.0		
37.5	0.0	100.0		
25.0	2.8	97.2		
19.0	5.4	91.8		
12.5	9.5	82.3		
9.5	4.2	78.1		
4.75	10.8	67.3		
2.00	11.9	55.4		
0.850	9.8	45.6		
0.425	6.9	38.7		
0.250	4.6	34.1		
0.150	4.4	29.7		
0.075	5.3	24.4		
PAN	24.4			

Sieve Mass (g): 10771.6

Gravel	32.7 %
Sand	42.9 %
Fines	24.4 %

COMMENTS

Amec Foster Wheeler Environment & Infrastructure

Per: S. Herrick, AScT

SIEVE ANALYSIS REPORT

amec foster wheeler

Westrek Geotechnical Services Ltd
101- 1285 Dalhousie Drive
Kamloops, BC
V2C 5Z5

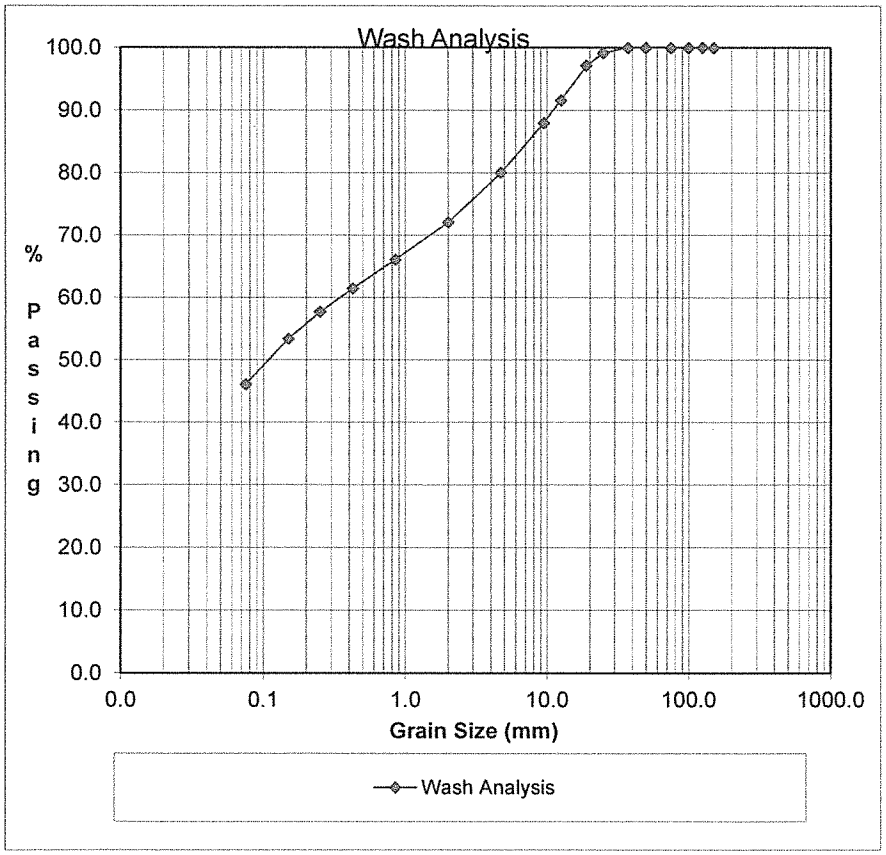
Project No:KX13690
Date: October 12, 2016

Attn: Simon Gautschi

Project Name: Bralorne Sewer

Test No.: 16-169-1 Source: TH-08 @ 7'-9' Sample Type: Bulk Sample

Date Sampled : October 7, 2016 By: Client Date Tested: October 12, 2016



Wash Sieve Analysis				
Sieve Size(mm)	Percent Retained	Percent Passing	Limits Upper	Limits Lower
150.0	0.0	100.0		
125.0	0.0	100.0		
100.0	0.0	100.0		
75.0	0.0	100.0		
50.0	0.0	100.0		
37.5	0.0	100.0		
25.0	0.9	99.1		
19.0	2.0	97.1		
12.5	5.5	91.6		
9.5	3.6	88.0		
4.75	8.0	80.0		
2.00	8.0	72.1		
0.850	5.9	66.1		
0.425	4.7	61.5		
0.250	3.8	57.7		
0.150	4.3	53.4		
0.075	7.3	46.1		
PAN	46.1			

Sieve Mass (g): 8360.4

Gravel	20.0 %
Sand	34.0 %
Fines	46.1 %

COMMENTS

Amec Foster Wheeler Environment & Infrastructure

Per: S. Herrick, AScT