CONTRACT SPECIFICATIONS

FOR

C-9B SUBDIVISION – PHASE 2

WHITEHORSE, YUKON

MAY, 2024

Seal

Prepared by Associated Engineering (B.C.) Ltd.

DRAWINGS BOUND SEPARATELY

Phase 2

Sheet No.	Drawing Number	Drawing Title
1	2183-17a-G-001	Cover
2	2183-17a-C-001	Drawing List
3	2183-17a-C-002	Legend
4	2183-17a-C-003	Whistle Bend On & Off Site Limits
5	2183-17a-C-004	Grubbing & Stripping Plan
6	2183-17a-C-401	Drawing Index
7	2183-17a-C-402	Lot Pre-Grading Plan
8	2183-17a-C-403	Future Lot Grades
9	2183-17a-C-404	Hydrant Coverage Plan
10	2183-17a-C-405	Sign & Line Painting Overall Plan
11	2183-17a-C-406	Erosion & Sediment Control Plan
12	2183-17a-C-101	Kishwoot Street – Sta. 1+000 to 1+320
13	2183-17a-C-102	Rear Lane 1 – Sta. 15+000 to 15+250
14	2183-17a-C-103	Rear Lane 1 – Sta. 15+250 to 15+460
15	2183-17a-C-104	Frank Slim Avenue Extension – Sta. 3+000 to 3+260
16	2183-17a-C-105	Rear Lane 2 – Sta. 14+080 to 14+300
17	2183-17a-C-106	Water Main Details
18	2183-17a-C-140	Spot Elevation & Curb Return Details
19	2183-17a-C-301	Typical Cross Sections
20	2183-17a-C-501	Typical Details Sheet 1 of 7 Based on City of Whitehorse SSM
21	2183-17a-C-502	Typical Details Sheet 2 of 7 Based on City of Whitehorse SSM
22	2183-17a-C-503	Typical Details Sheet 3 of 7 Based on City of Whitehorse SSM
23	2183-17a-C-504	Typical Details Sheet 4 of 7 Based on City of Whitehorse SSM
24	2183-17a-C-505	Typical Details Sheet 5 of 7 Based on City of Whitehorse SSM
25	2183-17a-C-506	Typical Details Sheet 6 of 7 Based on City of Whitehorse SSM
26	2183-17a-C-507	Typical Details Sheet 7 of 7 Based on City of Whitehorse SSM

Phase 1 – For Information Only

Sheet No.	Drawing Number	Drawing Title
1	2183-17-G-001	Cover
2	2183-17-C-001	Drawing List
3	2183-17-C-002	Legend
4	2183-17-C-003	Whistle Bend On & Off Site Limits
5	2183-17-C-004	Grubbing & Stripping Plan
6	2183-17-C-401	Hydrant Coverage Plan
7	2183-17-C-402	Sign & Line Parking Overall Plan
8	2183-17-C-403	Erosion & Sediment Control Plan
9	2183-17-C-101	Overall Lot Layout
10	2183-17-C-102	Lot Pre-Grading Plan
11	2183-17-C-103	Future Lot Grades
12	2183-17-C-104	Road 1 – Sta. 1+000 to 1+240
13	2183-17-C-105	Road 2 – Sta. 3+080 to 3+200 & PUL Sta. 2+000 to 2+100
14	2183-17-C-106	Road 3 – Sta. 14+000 to 14+220
15	2183-17-C-140	Spot Elevation & Curb Return Details

Sheet No.	Drawing Number	Drawing Title
16	2183-17-C-301	Typical Cross Sections
17	2183-17-C-501	Typical Details Sheet 1 of 7 Based on City of Whitehorse SSM
18	2183-17-C-502	Typical Details Sheet 2 of 7 Based on City of Whitehorse SSM
19	2183-17-C-503	Typical Details Sheet 3 of 7 Based on City of Whitehorse SSM
20	2183-17-C-504	Typical Details Sheet 4 of 7 Based on City of Whitehorse SSM
21	2183-17-C-505	Typical Details Sheet 5 of 7 Based on City of Whitehorse SSM
22	2183-17-C-506	Typical Details Sheet 6 of 7 Based on City of Whitehorse SSM
23	2183-17-C-507	Typical Details Sheet 7 of 7 Based on City of Whitehorse SSM

END OF DOCUMENT

Sealed bids marked "Bid for C-9B Subdivision – Phase 2" will be received at the offices of Associated Engineering (B.C.) Ltd., June 4, 2024 up to 4:00:00 PM local time.

The work involves comprises generally of the supply and installation of water mains, sewer mains, and storm sewers, general excavation and lot grading, installation of granular materials, installation of shallow utilities, concrete and asphalt surface works, and related works.

Contract Documents may be examined at the offices of Associated Engineering (B.C.) Ltd.
Digital copies of documents will be provided to interested General Contractors.

Contract Documents will be issued to invited General Contractors on or after May 21, 2024

Technical inquiries by bidders are to be directed to Steven Bartsch, P.Eng. at bartschs@ae.ca by email.

Bids must be accompanied by the specified Bid Bond and Consent of Surety Company payable to the Owner.

The lowest or any bid will not necessarily be accepted.

Owner:
Ta'an Kwäch'än Council
117 Industrial Road, Whitehorse, YT Y1A 2T8

Engineer:
Associated Engineering (B.C.) Ltd.
301-4109 4th Ave, Whitehorse, YT Y1A 1H6

General

1.1 DEFINITIONS

.1 Definitions

.1 "**Bid Closing Time**" means the time and date stipulated for receipt of bids in Article 1.3.1.1 of this Section as may be amended by addendum

.2 "**Bid Documents**" means the bid documents obtained in accordance with Article 1.3.1.1 of these Instructions to Bidders and comprising all of the documents and drawings listed in the Table of Contents thereof and any addenda that may be issued thereto.

.3 "**Bid Form**" means Section 00 41 00 of the Bid Documents and the supplements thereto.

.4 "**Bidder**" means any holder of Bid Documents.

.5 "**Total Bid**" means the amount entered by the Bidder into the Bid Form as may be adjusted as provided for by Articles 1.9.7.1 and 1.9.7.4 of this Section.

.2 Additional Definitions

.1 The definitions set out in Section 00 72 00 - General Conditions are incorporated into and form part of this Section 00 21 13 - Instructions to Bidders.

1.2 LIMITATION OF LIABILITY

.1 The Bidder agrees that the Owner's sole obligation, in return for the Bidder's preparation and submission of its bid, is to give consideration to the bid in accordance with the Contract Documents. The Bidder hereby waives any claim for damages or costs of any nature against the Owner and the Engineer (including, without limitation, the cost of preparing and submitting the bid, and any anticipated profits and contributions to overhead) arising out of the Owner's use of its discretion under the Contract Documents and the Engineer's advice to the Owner.

1.3 INVITATION

.1 Bid Call

.1 Offers signed under seal, executed, and dated will be received by Engineer located at 301-4109 4th Ave, Whitehorse, Yukon, Y1A 1H6 before 4:00:00 PM local time on June 4, 2024.

.2 Offers received after the Bid Closing Time will be returned to the Bidder unopened.

.3 Offers will be opened privately after the Bid Closing Time.

1.4 INTENT

.1 The intent of this bid process is to obtain an offer to perform work to complete a residential subdivision development for a Unit Price, in accordance with the Contract Documents. Refer to Section 01 11 00 - Summary of Work for a description of work required and conditions under which work will be carried out.

1.5 CONTRACT/BID DOCUMENTS

.1 Availability

.1 Bid Documents shall be obtained at the office of Engineer located at 301-4109 4th Ave, Whitehorse, Yukon. Only PDF documents will be issued.

.2 General Contractors obtaining Bid Documents must provide contact information (fax number, phone number, email address, mailing address) when obtaining Bid Documents. Accurate and complete contact information is required for distribution of addenda, if any.

.3 Bid documents irregularly obtained from sources other than those provided for in Article 1.5.1.1 ("unofficial bid documents") are used entirely at the risk of the Person who holds them. Neither Engineer nor Owner undertakes to provide information or addenda to Persons holding unofficial bid documents. Any use which a Person makes of unofficial bid documents or any reliance on or decisions to be made based on them, are the responsibility of such Persons. Engineer and Owner accept no responsibility for damages, if any, suffered by any Person as a result of decisions made or actions based on unofficial bid documents. Bids received from Persons holding unofficial bid documents may be declared informal at the sole and unfettered discretion of the Owner and if so declared will be rejected.

.4 Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not confer a license or grant for other purposes.

.5 Refer to Section 00 31 00 - Information Available to Bidders for identification of information available to Bidders.

.2 Examination

.1 Bid Documents may be viewed at the office of Engineer.

.2 Upon receipt of Bid Documents, verify that documents are complete. Notify Engineer should the documents be incomplete.

.3 Immediately notify Engineer upon finding discrepancies or omissions in Bid Documents.

.3 Queries/Addenda

.1 Direct written questions to Steven Bartsch, P.Eng., telephone 867.456.2711, email bartschs@ae.ca.

.2 Addenda will be in written form and may be issued during the bidding period. All addenda become part of the Contract Documents. Include costs in the Total Bid.

.3 Verbal answers are only binding when confirmed by addendum.

.4 Clarifications requested by Bidders must be in writing not less than five (5) Business Days before Bid Closing Time. The reply will be in the form of an addendum, a copy of which will be forwarded to known Bidders.

1.6 SITE ASSESSMENT

.1 Site Examination

.1 Visit the Project Site and surrounding area before submitting a bid.

1.7 BID SUBMISSION

.1 Bid Ineligibility

.1 Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain unbalanced prices, arithmetical errors, or irregularities of any kind, may, at the discretion of Owner, be declared informal. If so declared, the bid will be rejected.

.2 Bids with Bid Form Bid Bond, or enclosures which are improperly prepared may, at the discretion of Owner, be declared informal. If so declared, the bid will be rejected.

.3 Bids that fail to include bonding or insurance requirements may be declared informal. If so declared, the bid will be rejected.

.4 Bids are by invitation only from selected Bidders. Bids from unsolicited Bidders will be returned.

.2 Submissions

.1 Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.

.2 Submit one copy of the executed offer on the Bid Form provided, signed with original signature(s), and corporate sealed where applicable, together with the required Bid Bond in a closed opaque envelope, clearly identified with Bidder's name, project name and Owner's name on the outside. The second copy of the Bid Form is provided for Bidder's records.

.3 Do not submit Bid Documents with Bid Form.

.4 Bids received by fax or email shall be rejected.

.3 Bid Modifications

.1 Written amendments to the submitted offer shall be permitted if received in hard copy at the office where bids are being opened prior to Bid Closing Time, provided that bid amendments are endorsed by the same party or parties who signed and sealed the offer.

.2 The onus is on Bidder to ensure timely receipt of bid modifications. Owner makes no assurances regarding availability of fax communication lines or equipment. To be considered, fax transmissions of bid modifications must be received in full prior to Bid Closing Time.

.3 An amendment that expressly or by inference discloses Bidder's Total Bid or other material element of the bid, such that in the opinion of Owner the confidentiality of the bid is breached, shall be valid cause for Owner, at their sole discretion, to reject the bid.

.4 Amendments submitted via fax or email shall not be permitted.

.4 Bid Withdrawal

.1 Bidder shall be permitted to withdraw bid without prejudice, provided a request, in writing or by fax, signed by the same person or persons who signed the Bid Form, is received at the office designated in the Bid Documents before Bid Closing Time. Error on the part of Bidder in preparing the bid confers no right to the withdrawal of the bid after it has been opened.

1.8 BID ENCLOSURES/REQUIREMENTS

.1 Bid Security

.1 Bids shall be accompanied by a Bid Bond in an amount not less than 10 percent of the Total Bid.

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

.3 Use standard surety industry CCDC prescribed Bid Bond form. Bid Bond form CCDC 220 is included as a sample in Document 00 43 24.

.4 The Bid Deposit will be returned after execution of the Contract by the accepted Bidder.

.5 If no contract is awarded, all Bid Deposits will be returned.

.6 If the accepted Bidder fails for any reason to execute Section 00 52 00 - Contract Agreement or to provide the surety bonds stipulated in Section 00 72 00 - General Conditions or the insurance stipulated in Section 00 73 16 - Insurance within the time agreed to in the Bid Form, and such extension of time as may be granted by Owner, the accepted Bidder or the accepted Bidder's surety shall pay to the Owner the amount of the difference in money between the Total Bid and the amount for which Owner may legally contract with another party to perform the work, if the latter amount be in excess of the former.

.2 Consent of Surety

.1 Submit with the Bid Form, a surety company's letter of consent, stating that the surety company is willing to supply the required Performance and Labour and Materials Payment Bonds.

.3 Surety Company

.1 Bid Bond and Consent of Surety must be issued by a surety company licensed to conduct business in the province or territory where the work is located.

.4 Performance Assurance

.1 The accepted Bidder shall provide Performance and Labour and Materials Payment Bonds as described in Section 00 72 00 - General Conditions.

.5 Cost of Bonds

.1 Include the cost of bonds in the Total Bid.

.6 Insurance

.1 Provide a signed "Undertaking of Insurance", on a standard form provided by the insurance company, stating their intention to provide insurance to Bidder in accordance with the insurance requirements of the Contract Documents.

.7 Bid Form Requirements

.1 Fill in unit prices where indicated in the Schedule of Quantities and Prices of Section 00 41 00 - Bid Form. Extend unit prices in accordance with quantities shown. Insert extensions in spaces provided.

.2 Quantities shown against items listed in the Schedule of Quantities and Prices are estimates and serve only to provide a basis for comparing bids. Payment in respect of these items will be in accordance with the Contract Documents.

.3 Fill in prices where indicated on Bid Form.

.4 In the event of a discrepancy between unit prices and extension, unit prices will govern and Engineer will correct extensions accordingly.

.5 In the event of a discrepancy between the sum of prices and Total Bid, prices will govern and Engineer will correct Total Bid accordingly.

.6 Include in price(s) bid supply of all materials except those specified to be supplied by others, all supervision, labour and equipment, and a provision for sales taxes, duties, overhead and profit. Total Bid shall represent the entire cost to Owner for the completed works as specified and shown on the drawings, exclusive only of GST/HST payable by Owner.

.7 The amount of GST or HST payable by Owner on goods and services provided under this Contract is in addition to the Total Bid and is to be shown on a separate line on the Bid Form.

.8 Bid analysis will be based on the Total Bid price, exclusive of GST/HST.

.9 Bidder, in submitting an offer, agrees to complete the Work by the date indicated in the Bid Form.

.8 Bid Signing

.1 The Bid Form shall be executed by Bidder as follows:

.1 Sole Proprietorship: signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature.

.2 Partnership: signature of all partners in the presence of a witness who will also sign. Insert the word partner under each signature.

.3 Limited Company: signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal.

.4 Joint Venture: each party of the joint venture shall execute the bid under their respective seals in a manner appropriate to such party as described above, similar to the requirements of a Partnership.

.9 Supplements to Bid Form to be submitted with bid:

.1 Document 00 43 24 - Bid Bond.

.2 Document 00 43 14 - Consent of Surety.

.10 Ta'an Kwäch'än Council Citizens

.1 Though not a requirement of the successful bidder, Ta'an Kwäch'än Council encourages citizen owned contractors to submit bids

.2 Encourages non-citizen contractors to utilize Ta'an Kwäch'än Council sub-contractors. A list of TKC sub-contractors can be obtained by emailing TKCDevelopments@taan.ca

.3 Encourages all contractors bidding on this tender to include TKC Citizens as employees

.4 Please include a short description of all TKC Citizen participation (as contractors or employees) on your submission.

1.9 OFFER ACCEPTANCE/REJECTION

.1 Duration of Offer

.1 Bids shall remain open to acceptance and shall be irrevocable for a period of sixty (60) days after the bid closing date.

.2 Acceptance of Offer

.1 Owner reserves the right to accept any offer, waive defects in any offer, or reject any or all offers.

.2 After acceptance of an offer by Owner, the Engineer, on behalf of Owner, will issue a written Notice of Award to accepted Bidder.

.3 Award Conditions

.1 The following conditions must be satisfied before Owner can make the award decision:

.1 Receipt of environmental approvals and permits from applicable authorities.

.2 Satisfactory funding agreements.

.3 Satifactory heritage assessment.

.4 Approval from the Ta'an Kwäch'än Council.

.2 These conditions may extend the requirement to Award within the time period stipulated.

Part 2 Products

NOT USED.

Part 3 Execution

NOT USED.

END OF DOCUMENT

Part 1 General

1.1 GEOTECHNICAL REPORT

.1 The geotechnical report bound with these documents has been prepared for the Engineer by an independent specialist consultant. While the data contained therein is believed to be accurate, any opinions or recommendations are solely those of the authors of the geotechnical report. Bidders must form their own conclusions from the data and shall make no claim at any time that any opinion or recommendation is incorrect or misleading. Neither Owner nor Engineer accepts responsibility for the contents of this report nor for the suggestions or recommendations contained therein, except for recommendations, if any, which have been specifically incorporated into the Specifications.

1.2 PHASE 1 DOCUMENTS

.1 Phase 1 documents are provided For Information Only. Bidders shall be responsible for confirming information provided and coordination with the Phase 1 Contractor.

.1 Issues for Construciton Package.

Part 2 Products

NOT USED

Part 3 Execution

NOT USED

END OF DOCUMENT

C-9B Subdivision – Phase 2

Ta'an Kwäch'än Council
117 Industrial Road
Whitehorse, YT Y1A 2T8

TO: Associated Engineering (B.C.) Ltd.

301-4109 4th Ave
Whitehorse, YT Y1A 1H6

The undersigned Bidder, having carefully examined the Contract Documents and locality of the proposed work, and having full knowledge of the work required and the materials to be furnished and used, hereby agrees to provide all necessary materials, supervision, labour and equipment and perform and complete all work, and fulfill everything as set forth and in strict accordance with the Contract Documents and Addenda numbered[1]_____ for the prices stated in the Schedule of Quantities and Prices.

C-9B – Phase 2 Subtotal	[2]	$
Contingency Allowance:	[3]	$ 200,000.00
Goods and Services Tax:	[2]	$
TOTAL BID: (including GST)	[2]	$

[1] Bidder to fill in each Addendum No. received, e.g., 1, 2, 3, etc. as applicable.
[2] To be completed by Bidder.
[3] Payment of the Contingency Allowance or portions thereof will only be made in the event that Changes are implemented as provided for in the General Conditions, in which case the amount of the payment will be determined as specified in the General Conditions. Any unused portion of the Contingency Allowance will be retained by Owner.

The undersigned also agrees:

Article I. that Owner is in no way obligated to accept this bid;

Article II. that Owner may, at Owner's discretion, award to other than the low Bidder;

Article III. that, if the Bid Form is improperly completed or incomplete, Owner shall have the right to disqualify and/or reject this bid;

Article IV. that this bid is made without knowledge of the bid prices to be submitted for this work by any other company, firm, or person;

Article V. that this bid is made without any connection or arrangement with any other company, firm, or person submitting a bid for this work;

Article VI. that this bid is made without any undisclosed connection or arrangement with any other company, firm, or person having an interest in this bid or in the proposed Contract;

Article VII. that this bid is irrevocable for sixty (60) days after the closing date for receipt of bids and that the Owner may, at any time within such period, accept this bid whether any other bid has previously been accepted or not and whether Notice of Award of a contract has been given or not;

Article VIII. to deposit with Owner a Performance Bond and Labour and Material Payment Bond on the forms provided in these documents and for the amount specified in the General Conditions and the specified insurance endorsement certificates and execute the Contract Agreement in accordance with the time periods specified in the General Conditions, such time periods being extended only on the written approval of Owner;

Article IX. to commence and proceed actively with the work promptly following receipt of the Notice to Proceed, and to complete all work under the Contract within the Contract Time subject to the provisions of the General Conditions for extension of Contract Time;

Article X. to compensate Owner in accordance with the Contract Documents if the work is not completed within the Contract Time;

Article XI. to do all extra work not reasonably inferable from the specifications or drawings, but called for in writing by Engineer and to accept as full compensation therefor payment in accordance with the provisions of the General Conditions;

Article XII. that estimates of quantities shown in the Bid Form serve only to provide a basis for comparing bids and that no representations have been made by either Owner or Engineer that the actual quantities will even approximately correspond therewith, and further, that Owner has the right to increase or decrease the quantities in any or all items and to eliminate items entirely from the work;

Article XIII. that payment for the work done will be made on the basis of the quantities measured by Engineer and at the prices shown in the Bid Form which shall be compensation in full for the work done under the terms of the Contract, exclusive of GST payable by Owner; and

Article XIV. that payment for the work done will be made at the bid price(s) which shall be compensation in full for the work done under the terms of the Contract, exclusive of GST payable by Owner; and

Article XV. that, in preparing this bid, the Bidder has drawn their own conclusions from the data contained in the geotechnical report bound with these documents and has not relied on the opinions or the recommendations of the authors of the geotechnical report.

SCHEDULE OF QUANTITIES AND PRICES

The following are our prices, exclusive of GST payable by the Owner, for the cost of work for each item as outlined in the respective payment clauses in the Specifications.

Ta'an Kwach'an C-9B - Phase 2

	SUMMARY	SUBTOTALS
A.	SITEWORKS	$
B.	WATERWORKS	$
C.	SANITARY SEWERS	$
D.	STORM SEWER AND OVERLAND DRAINAGE	$
E.	WATER & SEWER SERVICE CONNECTIONS	$
F.	ROADWORKS	$
G.	SHALLOW UTILITIES	$
H.	MISCELLANEOUS PROVISONAL ITEMS	$
I.	CONTINGENCY ALLOWANCE	$ 200,000
J.	GOODS AND SERVICE TAX (INCLUDING CONTINGENCY ALLOWANCE)	$
	Total Including GST	$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
A.	**A.**	**SITEWORKS**				
1.0	1.0	MOBILIZATION / DEMOBILIZATION	1.00	LS	$	$
2.0	2.0	ENVIRONMENTAL COMPLIANCE	1.00	LS	$	$
3.0	3.0	TRAFFIC CONTROL	1.00	LS	$	$
4.0	4.0	CONSTRUCTION SURVEYING	1.00	LS	$	$
5.0	5.0	UTILITY COORDINATION	1.00	LS	$	$
6.0	6.0	UTILIZATION OF CITY FORCES	1.00	LS	$	$
7.0	7.0	CLEARING, SALVAGE AND DECKING (PROVISIONAL)	1.90	Ha.	$	$
8.0	8.0	GRUBBING, STRIPPING AND DISPOSAL (PROVISIONAL)	1.90	Ha.	$	$
9.0	9.0	LAYDOWN AREA (PROVISIONAL)	1.00	LS	$	$
			SITEWORKS SUBTOTAL			$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
B.	**B.**	**WATERWORKS**				
		TRENCHING AND NATIVE BACKFILL				
1.0	1.0	TRENCHING AND NATIVE BACKFILL (all Depths and Widths)	295	l.m.	$	$
		SUPPLY AND INSTALL WATERMAIN (PVC OR DI)				
1.0	2.0	WATERMAIN - 150mm DIA	145	l.m.	$	$
2.0	2.0	WATERMAIN - 200mm DIA	150	l.m.	$	$
		SUPPLY AND INSTALL WATERMAIN FITTINGS				
2.0	3.0	H x F ADAPTER - 150mm DIA	4	ea.	$	$
3.0	3.0	H x F ADAPTER - 200mm DIA	6	ea.	$	$
4.0	3.0	FxFxF TEE - 200mm DIA	2	ea.	$	$
5.0	3.0	CAP or BLIND FLANGE C/W MAIN STOP	2	ea.	$	$
6.0	3.0	45.0 BEND HxH OR HxF - 150mm DIA	2	ea.	$	$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
7.0	3.0	45.0 BEND HxH OR HxF - 200mm DIA	4	ea.	$	$
		SUPPLY AND INSTALL HYDRANT ASSEMBLY				
8.0	4.0	HYDRANT ASSEMBLY 200 DIA	1	ea.	$	$
		SUPPLY AND INSTALL WATER MAIN VALVE				
9.0	5.0	FxF GATE VALVE (incl. Hardware to Road Surface) - 150mm DIA	2	ea.	$	$
10.0	5.0	FxF GATE VALVE (incl. Hardware to Road Surface) - 200mm DIA	4	ea.	$	$
11.0	6.0	RELOCATE EXISTING GATE VALVE (ALL SIZES)	1	ea.	$	$
		TIE-IN TO EXISTING WATERMAIN				
12.0	7.0	TIE TO EXISTING WATERMAIN	1	ea.	$	$
		WATER SYSTEM PRESURE, LEAKAGE AND EXPANSION TESTING				
13.0	8.0	WATER SYSTEM PRESURE, LEAKAGE AND EXPANSION TESTING	1	LS	$	$
		WATER SYSTEM DISINFECTION, FLUSHING AND COMMISSIONING				
14.0	9.0	WATER SYSTEM DISINFECTION, FLUSHING AND COMMISSIONING	1	LS	$	$
				WATERWORKS SUBTOTAL		$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
C.	**C.**	**SANITARY SEWERS**				
		TRENCHING AND NATIVE BACKFILL				
1.0	1.0	TRENCHING AND NATIVE BACKFILL (all Depths and Widths)	85	l.m.	$	$
		SUPPLY AND INSTALL UNINSULATED SEWER MAIN PVC DR35 or DI PC 350 c/w Bedding				
2.0	2.0	SANITARY SEWER - 200mm DIA	85	l.m.	$	$
		SUPPLY AND INSTALL MANHOLE BARRELS				
3.0	3.0	MANHOLE BARREL - 1200 mm DIA	3	v.m.	$	$
		SUPPLY AND INSTALL MANHOLE FRAME, COVER & BASE 1200mm DIA				
4.0	4.0	MANHOLE FRAME, COVER & BASE 1200mm DIA	1	ea.	$	$
5.0	5.0	SUPPLY AND INSTALL MANHOLE BLEEDERS SERVICE, MAIN TO MANHOLE	1	ea.	$	$
6.0	6.0	SUPPLY AND INSTALL FROST COVER	1	ea.	$	$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
		T.V. INSPECTION AND REPORTING				
7.0	7.0	T.V. INSPECTION AND REPORTING	1	LS	$	$
		CONNECTION TO EXISTING INFRASTRUCTURE				
8.0	8.0	CONNECTION TO EXISTING MANHOLE OR CHAMBER	1	ea.	$	$
				SANITARY SEWER SUBTOTAL		$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
D.	**D.**	**STORM SEWERS AND OVERLAND DRAINAGE**				
		TRENCHING AND NATIVE BACKFILL				
1.0	1.0	TRENCHING AND NATIVE BACKFILL (all Depths and Widths) (PROVISIONAL)	175	l.m.	$	$
		REMOVE AND REINSTALL STORM SEWER MAIN c/w Bedding				
2.0	2.0	300 mm DIA (PROVISIONAL)	155	l.m.	$	$
3.0	2.0	450 mm DIA (PROVISIONAL)	20	l.m.	$	$
		REMOVE AND REINSTALL MANHOLE BARRELS				
3.0	3.0	1200 mm DIA (PROVISIONAL)	10.0	ea.	$	$
		REMOVE AND REINSTALL MANHOLE FRAME, COVER & BASE				
4.0	4.0	1200mm DIA (PROVISIONAL)	3.0	ea.	$	$
		REMOVE AND REINSTALL CATCH BASIN				
5.0	5.0	CATCH BASIN - 600 mm DIA (PROVISIONAL)	4.0	ea.	$	$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
		REMOVE AND REINSTALL CATCH BASIN LEAD				
6.0	6.0	CATCH BASIN LEAD - 300 mm DIA (PROVISIONAL)	25	l.m.	$	$
		T.V. INSPECTION AND REPORTING				
7.0	7.0	T.V. INSPECTION AND REPORTING	1	LS	$	$
				STORM SEWER & OVERLAND DRAINAGE SUBTOTAL		$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
E.	**E.**	**WATER & SEWER SERVICE CONNECTIONS**				
		TRENCHING AND NATIVE BACKFILL				
1.0	1.0	TRENCHING AND NATIVE BACKFILL TO NEW MAIN (all Depths and Widths)	140	l.m.	$	$
2.0	2.0	TRENCHING AND NATIVE BACKFILL TO EXISTING MAIN (all Depths and Widths)	225	l.m.	$	$
		SUPPLY AND INSTALL INSULATED WATER SERVICE & RECIRCULATION LINES, MAIN TO THREE (3) METERS BEYOND PROPERTY LINE				
3.0	3.0	INSULATED HDPE DR11, CTS 25mm DIAMETER & 20mm DIAMETER TO 3m BEYOND PROPERTY LINE (NEW Main)	130	l.m.	$	$
4.0	4.0	INSULATED HDPE DR11, CTS 25mm DIAMETER & 20mm DIAMETER TO 3m BEYOND PROPERTY LINE (EXISTING MAIN)	225	l.m.	$	$
5.0	5.0	20 mm DIA MAIN STOP c/w SADDLE	25	ea.	$	$
6.0	5.0	25 mm DIA MAIN STOP c/w SADDLE	24	ea.	$	$
7.0	5.0	50 mm DIA MAIN STOP c/w SADDLE	1	ea.	$	$
8.0	6.0	20 mm DIA CURB STOP	25	ea.	$	$
9.0	6.0	25 mm DIA CURB STOP	24	ea.	$	$
10.0	7.0	SUPPLY AND INJECT NON-TOXIC GREASE INTO CURB STOP	24	ea.	$	$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
		SUPPLY AND INSTALL SANITARY SERVICE, MAIN TO 3m BEYOND PROPERTY LINE				
11.0	8.0	UNINSULATED PVC 100 mm DIA - NEW MAIN TO 3m BEYOND PROPERTY LINE	130	l.m.	$	$
12.0	9.0	UNINSULATED PVC 100 mm DIA - EXISTING MAIN TO 3m BEYOND PROPERTY LINE	175	l.m.	$	$
		SUPPLY AND INSTALL SANITARY SERVICE, MAIN TO 3m BEYOND PROPERTY LINE				
13.0	10.0	SANITARY SEWER SERVICE CONNECTION TO MAIN (PROVISIONAL)	24	ea.	$	$
14.0	11.0	SANITARY SEWER SERVICE CONNECTION TO MANHOLE (PROVISIONAL)	1	ea.	$	$
				WATER & SEWER SERVICE CONNECTIONS SUBTOTAL		$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
F.	**F.**	**ROADWORKS**				
		SUBGRADE PREPARATION				
1.0	1.0	SUBGRADE PREPARATION	4,000	m^2	$	$
		GRANULAR SUB-BASE COARSE				
2.0	2.0	GRANULAR SUB-BASE COURSE (50mm CRUSH) - 200 mm DEPTH	4,000	m^2	$	$
3.0	3.0	GRANULAR SUB-BASE (PIT RUN)	3,300	m^3	$	$
		COMMON EXCAVATION AND MATERIAL PLACEMENT				
4.0	4.0	COMMON EXCAVATION TO REUSE	4,000	m^3	$	$
5.0	5.0	COMMON EXCAVATION TO ONSITE STOCKPILE (PROVISIONAL)	500	m^3	$	$
6.0	6.0	LOT GRADING REUSE FROM ONSITE STOCKPILE	4,000	m^3	$	$
7.0	7.0	RIP RAP C/W GEOTEXTILE - 600mm DEPTH (PROVISIONAL)	100	m^2	$	$
8.0	8.0	TOPSOIL & HYDROSEEDING (PROVISIONAL)	500	m^2	$	$
		GRANULAR BASE COARSE				
9.0	9.0	GRANUALR BASE COURSE (20mm CRUSH) - 150 mm DEPTH	4,000	m^2	$	$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
		CONCRETE CURB, GUTTER AND SIDEWALK				
10.0	10.0	SIDEWALK	550	m^2	$	$
11.0	11.0	CONCRETE CURB AND GUTTER - ROLLED CURB	165	l.m.	$	$
12.0	12.0	COMMERCIAL LANE CROSSING & BUS PADS	20	m^2	$	$
13.0	13.0	PARA-RAMPS	3.0	ea.	$	$
14.0	14.0	CONCRETE SWALE	10.0	m^2	$	$
15.0	15.0	CUTTING AND REMOVAL OF CONCRETE CURB AND GUTTER (PROVISIONAL)	20.0	l.m.	$	$
16.0	16.0	CUTTING AND REMOVAL OF CONCRETE SIDEWALK (PROVISIONAL)	50.0	m^2	$	$
		ASPHALT PAVEMENT				
17.0	17.0	WARM MIX ASPHALT CONCRETE - 75 mm DEPTH	3,600	m^2	$	$
18.0	18.0	CUTTING AND REMOVAL OF ASPHALT CONCRETE (PROVISIONAL)	100	m^2	$	$
		SUPPLY AND INSTALL ROAD MARKINGS & MISC.				
19.0	19.0	PAVEMENT MARKINGS - CROSSWALKS	1	ea.	$	$
20.0	19.0	PAVEMENT MARKINGS - 600 mm SOLID STOP BARS	1	ea.	$	$
21.0	20.0	INSTALL NEW STREET SIGN POSTS (PROVISIONAL)	1	ea.	$	$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
22.0	21.0	INSTALL NEW STREET IDENTIFICATION SIGNS (PROVISIONAL)	2	ea.	$	$
23.0	21.0	INSTALL NEW STREET REGULARTORY SIGNS (PROVISIONAL)	2	ea.	$	$
24.0	22.0	HYDRANT BOLLARDS (PROVISIONAL)	2	ea.	$	$
				ROADWORKS SUBTOTAL		$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
G.	**G.**	**SHALLOW UTILITIES**				
1.0	1.0	TRENCHING AND BACKFILL - PROVISIONAL	1,400	l.m.	$	$
2.0	2.0	STREET LIGHT BASES - PROVISIONAL	11	ea.	$	$
3.0	3.0	INSTALL ATCO ELECTRIC YUKON AND NORTHWESTEL SUPPLIED CONDUIT - PROVISIONAL	1,400	l.m.	$	$
4.0	4.0	INSTALL UTILITY COMPANY SUPPLIED PEDESTALS OR GROUND LEVEL BOXES- PROVISIONAL	3	ea.	$	$
5.0	4.0	INSTALL UTILITY COMPANY SUPPLIED VAULTS - 1 PIECE CONCRETE - PROVISIONAL	1	ea.	$	$
6.0	4.0	INSTALL UTILITY COMPANY SUPPLIED VAULTS - 2 PIECE CONCRETE - PROVISIONAL	3	ea.	$	$
7.0	5.0	CROSSING OF SHALLOW UTILITIES (PROVISIONAL)	3	ea.	$	$
				SHALLOW UTILITIES SUBTOTAL		$

Item No.	*M&P No.*	*Description*	*Estimated Quantity*	*Unit of Measurement*	*Unit Price*	*Extended Total Price*
H.	**H.**	**MISCELLANEOUS PROVISONAL ITEMS**				
1.0	1.0	UNSUITABLE TRENCH MATERIAL REPLACEMENT	500	m^3	$	$
2.0	2.0	UNSUITABLE TRENCH FOUNDATION MATERIAL REPLACEMENT	500	m^3	$	$
3.0	3.0	EXCAVATION OF BOULDERS (C/W OFFSITE DISPOSAL)	10	ea.	$	$
4.0	4.0	SUPPLY AND INSTALL TRENCH BOTTOM GEOTEXTILE	500	m^2	$	$
5.0	5.0	SUPPLY AND INSTALL SANITARY SERVICE RISERS c/w BENDS (PVC SDR 28) (PROVISIONAL)	30	v.m.	$	$
6.0	6.0	COMMON EXCAVATION TO OFFSITE DISPOSAL	750	m^3	$	$
7.0	7.0	LOT GRADING IMPORT	500	m^3	$	$
8.0	8.0	GRANULAR SUB-BASE COARSE (100 mm Pit Run)	750	m^3	$	$
9.0	9.0	SUPPLY AND INSTALL 50mm THICK HI-40 RIGID INSULATION	50	m^2	$	$
10.0	10.0	SUPPLY AND INSTALL CONCRETE LOCK BLOCKS	15	ea.	$	$
				MISCELLANEOUS PROVISIONAL ITEMS SUBTOTAL		$

SUPPLEMENTS TO BID FORM

The following Supplements to Bid Form are included with and form a part of our Bid. We understand that the information provided on these forms will be used by the Owner during Bid analysis.

00 43 24 - Bid Bond
00 43 14 - Consent of Surety Company

This bid is executed under seal at _____this _____ day of _____, 20__.

_____
Name of Firm

_____
Address

_____

For Individual or Partnership:
SIGNED, SEALED AND DELIVERED by:

_____ _____
Bidder (please print) Signature
in the presence of:
_____
Title
_____
Name
_____
Address
_____
City/Province/PC Seal
_____
Occupation

For Limited Company or Corporation:
The Corporate Seal of:

_____
Bidder (please print)

- was hereunto affixed in the presence of:

_____
Authorized Signing Officer Seal
Title

_____
Authorized Signing Officer
Title

NOTE: If the bid is by joint venture, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT

Supplement to Bid Form

We, the undersigned Surety Company, do hereby consent and agree to become bound as guarantor in a Performance Bond and Labour and Material Payment Bond each in the amount of fifty percent (50%) of the total bid for the fulfilment of the Contract, with

……..
as principal for the works specified in the Contract Documents entitled

……..
which Contract may be awarded within sixty (60) days from the closing date of bids to

…….
at the price(s) set forth in the Bid Form. The Bonds shall be issued in the form and manner specified within the Contract Documents. We hereby further declare that our Company is licensed to conduct business in the province or territory wherein the work is located and has a net worth greater than the amount of the required guarantee.

Surety Company

Signature for Surety Company

Title

Place ……

Date ……

END OF DOCUMENT

Supplement to Bid Form

Use CCDC standard form 220, an example of which follows.

BID BOND

No…… $.....

KNOW ALL MEN BY THESE PRESENTS THAT .....

..... as Principal

hereinafter called the Principal, and .....

a corporation created and existing under the laws of .....

and duly authorized to transact the business of Suretyship in .....

as Surety, hereinafter called the Surety, are held and firmly bound unto .....

..... as Obligee

hereinafter called the Obligee, in the amount of .....

..... Dollars ($)

lawful money of Canada, for the payment of which sum, well and truly to be made, the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a written tender to the Obligee, dated the .....

day of……, 20…… for.....

.....

.....

.....

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION is such that if the aforesaid Principal shall have the tender accepted within sixty (60) days from the closing date of tender and the said Principal will, within the time required, enter into a formal contract and give the specified security to secure the performance of the terms and conditions of the Contract, then this obligation shall be null and void. Otherwise the Principal and the Surety will pay unto the Obligee the difference in money between the amount of the bid of the said Principal and the amount for which the Obligee legally contracts with another party to perform the work if the latter amount be in excess of the former.

The Principal and the Surety shall not be liable for a greater sum than the specified penalty of this bond.

Any suit under this bond must be instituted before the expiration of six months from the date of this Bond.

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond this .....

…… day of ……, 20.....

SIGNED and SEALED
in the presence of

(
(
(
(……(Seal)
Principal

(
(
(
(……(Seal)
Surety

Supplement to Bid Form

It is our intention that the following work will, subject to Engineer's approval, be subcontracted to the firms indicated below. All other work will be performed by our own forces, except as authorized in writing by Engineer.

Trade & Equipment	Name of Subcontractor	Value

Contractor shall provide Construction Schedule to all Subcontractor of the Work and provide 7 days notice to subcontractors of changes or additional work.

END OF DOCUMENT

THIS AGREEMENT made this _____ day of _____ in the year 20__ by and between Ta'an Kwäch'än Council, herein called "Owner," and _____, herein called "Contractor".

WITNESSETH: That Contractor and Owner undertake and agree as follows:

ARTICLE 1.

Contractor shall:

1. Provide all necessary materials, labour, supervision and equipment, and perform all work and fulfill everything as set forth and in strict accordance with the Contract Documents and Addenda numbered [_____] for the project entitled "C-9B Subdivision – Phase 2" which have been prepared by Associated Engineering (B.C.) Ltd., acting as and hereby entitled Engineer; and

2. Commence to proceed actively with the work of the Contract promptly following receipt of the Notice to Proceed and achieve Total Performance of the Work July 31, 2025, subject to the provisions for the extension of Contract Time stipulated in the General Conditions.

ARTICLE 2.

Owner will pay to Contractor, as full compensation for the performance and fulfilment of this Contract, the sum or sums of money specified herein in the manner and at the times specified in the Contract Documents.

ARTICLE 3.

All of the Contract Documents, including but not limited to the Invitation to Bid, Instructions to Bidders, Information Available to Bidders, Bid Form, Bonds, Insurance, General Conditions, Supplementary Conditions, Special Provisions, Addenda, Appendices, Specifications and Drawings, whether annexed hereto or contained in a separate volume, are incorporated herein and form a part of this Agreement as fully to all intents and purposes as though recited in full herein, and the whole shall constitute the Contract between the parties, and it shall enure to the benefit of and be binding upon them and their successors, executors, administrators, and assigns.

ARTICLE 4.

No implied contract of any kind whatsoever, by or on behalf of Owner, shall arise or be implied from anything contained in this Contract or from any position or situation of the parties at any time, it being understood and agreed that the express contracts, covenants, and agreements contained herein and made by the parties hereto are and shall be the only contracts, covenants, and agreements on which any rights against Owner may be founded.

ARTICLE 5.

Subject to Article 3, this Agreement shall supersede all communications, negotiations, and agreements, either written or verbal, made between the parties hereto in respect of matters pertaining to this Agreement prior to the execution and delivery hereof.

ARTICLE 6.

Any Notice to be given by either Party pursuant to this Agreement, or Engineer, shall be in writing and delivered personally, by commercial courier or transmitted by email to the following addresses and fax numbers, as applicable:

Contractor at:
Address:
Fax:
E-mail:
Owner at: Ta'an Kwäch'än Council
Address: 117 Industrial Road, Whitehorse, Yukon, Y1A 2T8
Fax: N/A
E-mail: housingmanager@taan.ca
Engineer at: Associated Engineering (B.C.) Ltd.
Address: Whitehorse, Yukon, Y1A 1H6
Fax: N/A
E-mail: bartschs@ae.ca

A Notice delivered personally or by commercial courier shall be deemed to have been given and received on the date on which it was delivered if delivered on a Business Day during the regular business hours of the recipient or if it is delivered on a day that is not a Business Day or outside the regular business hours of the recipient, the Notice shall be deemed to have been delivered on the following Business Day.

A Notice transmitted by fax shall be deemed to have been given and received on the date on which it was delivered if delivered on a Business Day during the regular business hours of the recipient or if it is transmitted on a day that is not a Business Day or outside the regular business hours of the recipient, the Notice shall be deemed to have been delivered on the following Business Day.

A Notice transmitted by e-mail shall be deemed to have been given and received on the date on which receipt of the e-mail is acknowledged by the intended recipient or receipt by the intended recipient is confirmed by the sender of the e-mail.

A Party may change its address for receipt of Notices at any time by giving Notice of the change to the other Party and Engineer in accordance with this provision. Engineer may change its address for receipt of Notices at any time by giving Notice of the change to the Parties in accordance with this provision. Such changed address for receipt of Notices will be effective five (5) Business Days after receipt of the Notice by the recipient.

ARTICLE 7.

In accordance with Canadian anti-spam legislation, each Party and the Engineer consent to contacting each other and their personnel through electronic messages relating to the Project. Following completion of the Project, either Party may withdraw consent by providing Notice to the Party or Engineer in respect of which consent is withdrawn.

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

SIGNED, SEALED AND DELIVERED by:

For Limited Company:

The Corporate Seal of:

Contractor (please print)

was hereunto affixed in the presence of:

Authorized Signing Officer Title Seal

Signature

NOTE: If Contractor is a joint venture, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF DOCUMENT

Use CCDC standard form 221, an example of which follows.

PERFORMANCE BOND

No…… $ .....

KNOW ALL MEN BY THESE PRESENTS THAT .....

..... as Principal

hereinafter called the Principal, and .....

a corporation created and existing under the laws of .....

and duly authorized to transact the business of Suretyship in .....

as Surety, hereinafter called the Surety, are held and firmly bound unto .....

..... as Obligee

hereinafter called the Obligee, in the amount of .....

…… Dollars ($.....)

lawful money of Canada, for the payment of which sum, well and truly to be made, the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a written tender to the Obligee, dated the .....

day of ……, 20…….. for .....

.....

.....

.....

in accordance with the Contract Documents submitted therefor which are by reference made part hereof and are hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION is such that if the Principal shall promptly and faithfully perform the Contract then this obligation shall be null and void; otherwise it shall remain in full force and affect.

Whenever the Principal shall be, and declared by the Obligee to be, in default under the Contract, the Obligee having performed the Obligee's obligations thereunder, the Surety shall promptly remedy the default, or shall promptly:

(1) complete the Contract in accordance with its terms and conditions, or

(2) obtain a bid of bids for submission to Obligee for completing the Contract in accordance with its terms and conditions, and upon determination by the Obligee and the Surety of the lowest responsible bidder, arrange for a contract between such bidder and the Obligee and make available as work progresses (even though there should be a default, or a succession of defaults, under the contract or contracts of completion, arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of Contract price", as used in this paragraph, shall mean the total amount payable by the Obligee to the Principal under the Contract, less the amount properly paid by the Obligee to the Principal.

Any suit under this Bond must be instituted before the expiration of two (2) years from the date on which the final payment under the Contract falls due.

The Surety shall not be liable for a greater sum than the specified penalty of the Bond.

No right of action shall accrue on this Bond, to or for the use of, any person or corporation other than the Obligee named herein, or the heirs, executors, administrators or successors of the Obligee.

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond this .....

…….. day of ……, 20….

SIGNED and SEALED
in the presence of

(
(
(
(…….(Seal)
Principal

(
(
(
(……..(Seal)
Surety

Use CCDC standard form 222, an example of which follows.

LABOUR AND MATERIAL PAYMENT BOND
(TRUSTEE FORM)

No…… $.....

Note: This Bond is issued simultaneously with another Bond in favour of the Obligee conditioned for the full and faithful performance of the Contract.

KNOW ALL MEN BY THESE PRESENTS THAT .....

..... as Principal

hereinafter called the Principal, and .....

a corporation created and existing under the laws of .....

and duly authorized to transact the business of Suretyship in .....

as Surety, hereinafter called the Surety are, subject to the conditions hereinafter contained, held and firmly bound unto .....

..... as Trustee

hereinafter called the Obligee, for the use and benefit of the Claimants, their and each of their heirs, executors, administrators, successors and assigns, in the amount of .....

…… Dollars ($.....)

lawful money of Canada, for the payment of which sum well and truly to be made the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a written tender to the Obligee, dated the .....

day of ……..., 20 …… for.....

.....

.....

.....

which Contract Documents are by reference made a part hereof, and are hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITIONS OF THIS OBLIGATION is such that, if the Principal shall make payments to all Claimants for all labour and material used or reasonably required for use in the performance of the Contract, then this obligation shall be null and void; other wise it shall remain in full force and affect, subject however to the following conditions:

1. A Claimant for the purpose of this Bond is defined as one having a direct contract with the Principal for labour, material, or both, used or reasonably required for use in the performance of the Contract, labour and material being construed that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment directly applicable to the Contract provided that a person, firm or corporation who rents equipment to the Principal to be used in the performance of the Contract under a contract which provides that all or any part of the rent is to be applied towards the purchase price thereof, shall only be a Claimant to the extent of the prevailing industrial rental value of such equipment for the period during which the equipment was used in the performance of the Contract. The prevailing industrial rental value of equipment shall be determined, insofar as it is practical to do so, in accordance with and in the manner provided for in the latest revised edition of the publication of the Canadian Construction Association titled "Rental Rates on Construction Equipment" published prior to the period during which the equipment was used in the performance of the Contract.

2. The Principal and the Surety hereby jointly and severally agree with the Obligee, as Trustee, that every Claimant who has not been paid as provided for under the terms of his contract with the Principal, before the expiration of a period of ninety (90) days after the date on which the last of such Claimant's work or labour was done or performed or materials were furnished by such Claimant, may as a beneficiary of the trust herein provided for, sue on this Bond, prosecute to final judgment for such sum or sums as may be justly due to such Claimant under the terms of a contract with the Principal and have execution thereon. Provided that the Obligee is not obliged to do or take any act, action or proceeding against the Surety on behalf of the Claimants, or any of them, to enforce the provisions of this Bond. If any act, action or proceeding is taken either in the name of the Obligee or by joining the Obligee as a party to such proceeding, then such act, action or proceeding shall be taken on the understanding and basis that the Claimants or any of them, who take such act, action or proceeding, shall indemnify and save harmless the Obligee against all costs, charges and expenses or liabilities incurred thereon and any loss or damage resulting to the Obligee by reason thereof. Provided still further that, subject to the foregoing terms and conditions, the Claimants, or any of them, may use the name of the Obligee to sue on and enforce the provisions of this Bond.

3. No suit or action shall be commenced hereunder by any Claimant:

   (a) unless such Claimant shall have given written notice within the time limits hereinafter set forth to each of the Principal, the Surety and the Obligee, stating with substantial accuracy the amount claimed. Such notice shall be served by mailing the same by registered mail to the Principal, the Surety and the Obligee, at any place where an office is regularly maintained for the transaction of business by such persons or served in any manner in which legal process may be served in the Province or other part of Canada in which the subject matter of the Contract is located. Such notice shall be given:

      (1) in respect of any claim for the amount or any portion thereof, required to be held back from the Claimant by the Principal under either the terms of the Claimant's contract with the Principal, or under the Builders' (Mechanics') Liens Legislation applicable to the Claimant's contract with the Principal, whichever is the greater, within one hundred and twenty (120) days after such Claimant should have been paid in full under the Claimant's contract with the Principal;

      (2) in respect of any claim other than for the holdback, or portion thereof, referred to above, within one hundred and twenty (120) days after the date upon which such Claimant did, or performed, the last of the work or labour or furnished the last of the materials for which such claim is made under the Claimant's contract with the Principal;

   (b) after the expiration of one (1) year following the date on which the Principal ceased work on the Contract, including work performed under the guarantees provided in the Contract;

   (c) other than in a Court of competent jurisdiction in the Province or District of Canada in which the subject matter of the Contract, or any part thereof, is situated and not elsewhere, and the parties hereto agree to submit to the jurisdiction of the Court.

4. The Surety agrees not to take advantage of Article 1959 of the Civil Code of the Province of Quebec in the event that, by an act or an omission of the Claimant, the Surety can no longer be subrogated in the rights, hypothecs and privileges of said Claimant.

5. Any material change in the contract between the Principal and the Obligee shall not prejudice the rights or interest of any Claimant under this Bond, who is not instrumental in bringing about or has not caused such change.

6. The amount of this Bond shall be reduced by, and to the extent of any payment or payments made in good faith, and in accordance with the provisions hereof, inclusive of the payment by the Surety of Builders' (Mechanics') Liens which may be filed of record against the subject matter of the Contract, whether or not claim for such lien be presented under and against this Bond.

7. The Surety shall not be liable for a greater sum than the specified penalty of this bond.

IN WITNESS WHEREOF, the Principal and the Surety have Signed and Sealed this Bond this .....

day of ……, 20……

SIGNED and SEALED
in the presence of

(
(
(
(……..(Seal)
Principal

(
(
(
(……..(Seal)
Surety

CERTIFICATE OF INSURANCE

ISSUED TO:-

PROJECT:- DESCRIPTION:-

LOCATION:-

This is to certify that insurances as described herein, have been arranged through this office for the Insured named below on whose behalf this Certificate is executed and we hereby certify that such insurances are in full force and effect as of this date, but only with respect to the type(s) of insurance for which a policy number, policy period, and limits of liability or amount is shown.

INSURED:-

SCHEDULE OF INSURANCE			
TYPE OF INSURANCE	**COMPANY AND POLICY NUMBER**	**EFFECTIVE & EXPIRY DATES OF POLICY**	**LIMIT OF LIABILITY/AMOUNT**
COMPREHENSIVE GENERAL LIABILITY		EFFECTIVE	BODILY INJURY
		EXPIRY	$ EACH PERSON
			$ EACH ACCIDENT
			$ AGGREGATE PRODUCTS
			PROPERTY DAMAGE
			$ EACH ACCIDENT
			$ AGGREGATE PRODUCTS
			BODILY INJURY & PROPERTY DAMAGE
			$ INCLUSIVE
		WRAP UP ☐	$ AGGREGATE PRODUCTS
EMPLOYERS LIABILITY		EFFECTIVE	$ EACH PERSON
		EXPIRY	$ EACH ACCIDENT
AUTOMOBILE LIABILITY OWNED/LEASED VEHICLES		EFFECTIVE	BODILY INJURY
		EXPIRY	$ EACH PERSON
			$ EACH ACCIDENT
			PROPERTY DAMAGE
			$ EACH ACCIDENT
			BODILY INJURY & PROPERTY DAMAGE
			$ INCLUSIVE
AUTOMOBILE LIABILITY NON-OWNED VEHICLES		EFFECTIVE	BODILY INJURY
		EXPIRY	$ EACH PERSON
			$ EACH ACCIDENT
			PROPERTY DAMAGE
			$ EACH ACCIDENT
			BODILY INJURY & PROPERTY DAMAGE
			$ INCLUSIVE
UMBRELLA LIABILITY		EFFECTIVE	$ LIMITS
		EXPIRY	EXCESS OF $
BUILDERS RISK/ INSTALLATION FLOATER		EFFECTIVE	$ SITE
		EXPIRY	$ OTHER LOCATION
		WRAP UP ☐	$ TRANSIT
CONTRACTORS		EFFECTIVE	$
EQUIPMENT		EXPIRY	
WORKERS' COMPENSATION		EFFECTIVE	AS REQUIRED BY THE ORDINANCE(S)
		EXPIRY	OF THE
OTHER			

PARTICULARS OF INSURANCE

GENERAL LIABILITY	BUILDERS RISK/INSTALLATION FLOATER
☐ Premises Property and Operations	☐ All Risk Form
☐ Products and Completed Operations	☐ Fire, Extended Coverages, Riot, Vandalism or Malicious Acts
☐ Blanket Contractual (all written agreements)	☐ Difference in Conditions
☐ Tenants Fire Legal Liability	☐ Flood Included
☐ Owners and Contractors Protective	☐ Earthquake Included
☐ Occurrence Bodily Injury and Property Damage	☐ Excludes Faulty Workmanship, Faulty Construction or Faulty Design but not loss resulting therefrom
☐ Broad Form Property Damage	☐ Covers Transit by Land
☐ Contingent Employers Liability	☐ Covers Boiler Explosion during Installation, Temporary Operation and Testing
☐ Personal Injury	☐ Covers Owner as Additional Named Insured
☐ Sudden and Accidental Pollution Liability	☐ Grants Permission for Occupancy prior to completion
☐ Non-Owned Automobile Liability	☐ Waiver of Subrogation Against Additional Insureds
☐ Severability of Interest or Cross Liability	☐ 30 Days Notice of Cancellation
☐ Exclusions pertaining to Blasting, Collapse, Underpinning, deleted	☐
☐ Provides Coverage for Claims arising from Use of Machinery and Equipment attached to licensed construction machinery on Project Site	☐
☐ Employees as Additional Insured	☐
☐ Owner as Additional Insured	☐
☐ Engineer as Additional Insured	☐
☐ Waiver of Subrogation against Additional Insureds	☐
☐ 30 Days Notice of Cancellation	☐
☐	**CONTRACTORS EQUIPMENT**
☐	☐ Subrogation Waived Against Owner
☐	☐ Subrogation Waived Against Owner, Construction or Project Manager, Architects and Engineers
CONTINGENT EMPLOYERS LIABILITY	☐ 30 Days Notice of Cancellation
☐ 30 Days Notice of Cancellation	☐
☐	☐

AUTOMOBILE	NON-OWNED AUTOMOBILE
☐ 15 Days Notice of Cancellation	☐ 15 Days Notice of Cancellation
☐	☐

MARINE/AIRCRAFT	OTHERS
☐ 30 Days Notice of Cancellation	☐
MARINE/AIRCRAFT/CARGO	☐
☐ 30 Days Notice of Cancellation	☐
☐	☐

☒ **INDICATES THAT THE COVERAGE/ENDORSEMENT INDICATED IS INCLUDED**

REMARKS (STATE DEDUCTIBLE IF ANY)

TERMS AND CONDITIONS

This Certificate is issued for convenience only. All of the terms and conditions of the Policies referred to are contained in the original document which are not modified or amended by this Certificate.

In the event of cancellation or material change of the Policies referred to herein, the Insurer and/or the undersigned will provide written notice as indicated above.

DATED _____

_____
Authorized to sign on behalf of Insurers

Part 1

Part 1 PART 1 CONTRACT DOCUMENTS

1.1 GC 1. DEFINITIONS

In this Contract, the following definitions shall apply:

"Abnormal Weather" means adverse temperature, precipitation, wind or other adverse weather condition which, in any two (2) week period, differs from the statistical average for that condition in that period by more than one standard deviation, calculated based on relevant data available from Environment Canada, covering the twenty (20) year period immediately preceding the Notice of Award.

"**Business Day**" means any day other than a Saturday, Sunday or statutory holiday recognized in the province or territory wherein the Project Site is located.

"**Certificate of Insurance**" means a document issued by an insurance company or authorised broker to certify the extent, period and limits of insurance coverage under specific conditions granted to listed Persons.

"**Certificate of Substantial Performance**" means a certificate issued by the Engineer stating that Substantial Performance of the Work has been achieved.

"**Certificate of Total Performance**" means a certificate issued by the Engineer stating that Total Performance of the Work has been achieved.

"**Change**" means an increase or addition to, a reduction or deletion from or an extension of the Work or the Construction Schedule, or the replacement of a proposed subcontractor or supplier, which results in a material change to the Contract Time or Contract Price.

"**Change Directive**" means a written instruction signed by the Owner and issued by the Engineer to the Contractor directing the Contractor to proceed with a Change despite the absence of an agreement as to adjustment of the Contract Price or Contract Time, or both, as applicable.

"**Change Order**" means a written record of a Change prepared by the Engineer and signed by the Owner, the Engineer and the Contractor stating their agreement to a Change, and setting out a description of the Work covered by the Change Order, the price or method of valuation of the Work and the change in the Contract Price or adjustment of the Contract Time, or both, as applicable.

"**Claim**" means a written demand for adjustment of the Contract Price or Contract Time made by either Party against the other Party.

"**Confidential Information**" means all information that is acquired by, or becomes known to, the Contractor or any of its Personnel, or Subcontractors as a result of, directly or indirectly, performing the Work, or otherwise being involved in the Project and which is in the nature of one of the following categories of information:

(a) all information with respect to the Owner's operations, the Project and this Contract; or

(b) all personal information as defined in the Freedom of Information and Protection of Privacy legislation in the jurisdiction in which the Work is performed.

"**Consequential Damages**" means all damages except direct damages, including any one or more of: loss of profits or anticipated profits, loss of business opportunity, loss of revenue and loss of reputation.

"**Construction Equipment**" means all tools, machinery and equipment whether operated or not operated, which are required for preparing, fabricating, conveying, erecting or otherwise performing the Work but are not incorporated into the Work.

"**Construction Schedule**" means the schedule for the Work which is prepared by the Contractor and accepted by the Owner and the Engineer in accordance with GC 25 CONSTRUCTION SCHEDULE.

"**Construction Safety Plan**" means the plan developed by the Contractor to address safety on the Project Site, and anywhere else that the Work is performed.

"**Contemplated Change Notice**" means a written notification authorized and issued by or on behalf of the Owner, providing Notice and Specifications or Drawings, or both, to the Contractor and others of a contemplated Change and requesting a quotation for adjustments of Contract Price and Contract Time that would result from the Change.

"**Contract Documents**" or "**Contract**" means the complete set of documents, Specifications, Drawings, and addenda incorporated therein, as listed in the "Table of Contents" of the Contract, any Construction Memos and any amendments to the Contract.

"**Construction Memo**" means an instruction, not involving any adjustment to the Contract Price or Contract Time, in the form of Specifications, Drawings, schedules, samples, models or written instructions issued by the Engineer that in the opinion of the Engineer is necessary to supplement or clarify the Contract Documents as required for the performance of the Work.

"**Contract Price**" means, if the Contract is on the basis of a stipulated or lump sum, the lump sum price stated in Section 00 41 00 – Bid Form, as may be adjusted by Change Orders or Change Directives. If the Contract calls for payments on a unit price basis whether including lump sums or not, Contract Price shall mean the product of the units of Work actually performed and the appropriate unit prices plus the total of the lump sums prices all as stated in Section 00 41 00 – Bid Form, and all as may be adjusted by Change Orders or Change Directives.

"**Contract Time**" means the time stipulated in Article 1 of Section 00 52 00 - Contract Agreement as the period between the date of the Notice to Proceed and achievement of Total Performance of the Work, as may be adjusted by Change Orders or Change Directives.

"**Contractor**" means the Contractor named in Section 00 52 00 - Contract Agreement.

"**Deficiencies**" means one or more defects or deficiencies in the Work or Materials, including Work omitted or not performed as provided for in this Contract.

"**Dispute**" means any difference between the Contractor and the Owner as to the interpretation, application or administration of the Contract or any failure by the Owner and the Contractor to agree where the Contract Documents call for agreement.

"**Drawings**" means the graphic and pictorial drawings, sketches and representations, whether electronic or paper-based, prepared to represent the Work and issued by the Engineer, including plans, elevations, sections, details, schedules, and diagrams.

"**Engineer**" means Associated Engineering acting through a delegate duly appointed to act on its behalf, or such other engineer, architect or Person as may from time to time be duly authorized and appointed in writing by the Owner.

"**Force Account**" means the method of calculating payment the Contractor shall receive for the Work performed as set out in GC 56 FORCE ACCOUNT WORK.

"**Governmental Authority**" means any federal, provincial, first nation or municipal government, official, administrative, regulatory, or legislative authority, commission, tribunal or court or any of the respective agencies or departments thereof having jurisdiction over any aspect of the Project, the Work, this Contract, or any matters arising thereunder.

"**Law**" means the common law and all applicable decrees, statutes, laws, by-laws, rules, orders, codes, directives and regulations in effect from time to time and made or issued by any Governmental Authority having jurisdiction over any aspect of the Project, the Work, this Contract, the Owner, the Contractor and the Subcontractors, and includes any applicable replacement, amendment or supplementary legislation, and any applicable regulations, and further includes the OH&S Legislation.

"**Lien Act**" means the applicable provincial or territorial lien legislation, including regulations enacted pursuant to that lien statute, at the Project Site, current at the date of the Notice to Proceed and as may be revised during the Contract Time.

"**Materials**" means materials, supplies, machinery, equipment and fixtures which are or which are to be permanently incorporated into the Work, but excludes Construction Equipment.

"**Major Lien Fund Holdback**" means the total of lien holdbacks from progress payments for Work performed before Substantial Performance of the Work.

"**Milestone Date**" means any date or dates specified in the Contract Documents for completion of specified portions of the Work, including the dates of Substantial Performance of the Work and Total Performance of the Work.

"**Minor Lien Fund Holdback**" means the total of lien holdbacks from progress payments for Work performed after Substantial Performance of the Work.

"**Notice**" means a notice made in writing and delivered to one of the Parties or the Engineer at the address, or any replacement address, stipulated for and in the method required for, delivery or as set out in Article 6 of Section 00 52 00 - Contract Agreement.

"**Notice of Award**" is a communication from the Owner, or the Engineer on behalf of the Owner, advising a bidder that the bidder has been awarded the Contract.

"**Notice to Proceed**" is a direction from the Owner, or the Engineer on behalf of the Owner, advising the Contractor is to commence and proceed actively with the Work under the Contract.

"**OH&S Legislation**" means, collectively, all of the applicable decrees, statutes, laws, by-laws, rules, orders, codes, directives and regulations concerning occupational health and safety, which may be in force, from time to time at the Project Site.

"**Other Contractors**" means any other contractors or consultants which are retained directly by the Owner for other work at the Project Site, other than the Contractor, and includes the Owner's own forces.

"**Owner**" means the Person identified as such in Section 00 52 00 - Contract Agreement and includes any authorized representative of the Owner.

"**Party**" means one of the parties to this Contract and Parties means the Owner and the Contractor, collectively, as the case may be.

"**Payment Certificate**" has the meaning set out in GC 37 PROGRESS PAYMENTS.

"**Person**" means any one of an individual, partnership, limited liability partnership, limited liability company, corporation, sole proprietorship, trust, unincorporated organization, association, society, or Governmental authority.

"**Personnel**" means, without limitation:

(a) in relation to any Party and its affiliates, elected officials, directors, officers, employees, contract personnel, non-employed representatives, contractors, consultants and agents, including those who are assigned or seconded to the Project; and

(b) in relation to any other Person, each of their respective elected officials, directors, officers, employees, contract personnel, non-employed representatives, contractors, consultants and agents, including those who are assigned or seconded to the Project.

"**Pre-Contractual Statement**" means any communication or correspondence, including any agreement, undertaking, representation, warranty, promise, assurance, arrangement or draft of any nature whatsoever, whether or not in writing, relating to the subject matter of the Contract and which is not repeated in the Contract, made by any Person at any time before the date of the Contract Agreement.

"**Prime Contractor for Safety**" means "Prime Contractor", "Constructor", "Principal Contractor", or such other position of similar import as the case may be according to the location of the Project Site, as is defined in the OH&S Legislation.

"**Project**" means the project identified in Article 1 of Section 00 52 00 - Contract Agreement.

"**Project Record Drawings**" means a dedicated set of Drawings reserved and annotated by the Contractor on an ongoing basis during the performance of the Work for the purpose of recording differences between the built Work and Drawings.

"**Project Site**" means the designated location of the Work on the Project as identified in the Contract Documents, or, if not identified in the Contract Documents, as identified by the Owner by Notice to the Contractor, from time to time.

"**Project Takeover**" means the turnover by the Contractor and the takeover by the Owner of part, or all of, the Project, which may occur in phases, or not, as determined in the sole discretion of the Owner, and which shall occur when all of the prerequisites identified in this Contract have been completed by the Contractor, certified by the Engineer and accepted in writing by the Owner.

"**Project Takeover Date**" means the date that Project Takeover occurs in relation to a part, or all, of the Project.

"**Quantities**" means the quantities for the Work performed, measured in accordance with GC 39 QUANTITIES.

"**Records**" means the records of the Contractor and its Subcontractors relating to the Contract, the Project or the performance of the Work, and which include, paper and electronic copies, as the case may be, of:

(a) original invoices and accounts;

(b) records of account for all Work performed, itemizing the names and positions of Personnel, the hours worked by each, the type of services performed and the hourly rate charged, together with copies of all subcontracts and invoices for expenses;

(c) records of account for all amounts claimed related to termination or suspension, itemizing the names and positions of Personnel, the hours worked by each, the type of services performed and the hourly rate charged, together with copies of all subcontracts; and

(d) correspondence, minutes of meetings, notes, reports, incident reports and all other documentation including information relating to the Contractor's compliance with the Law and the Contract and the use of Confidential Information.

"**Shop Drawings**" means one or more Drawings, diagrams, illustrations, photographs, schedules, performance charts, technical brochures, samples, models and other data which are to be provided by or through the Contractor or the Subcontractors to illustrate details of a portion of the Work.

"**Specifications**" means those documents, whenever issued by the Engineer, setting out the requirements and standards for Materials, equipment, systems, workmanship and the services necessary for the proper performance of the Work or any part thereof.

"**Subcontractor**" means a Person who performs part of the Work, including the Supply of Materials, and either: (a) has a direct contract with the Contractor or (b) has no direct contract with the Contractor but is at any tier below the Contractor.

"**Substantial Performance of the Work**" means that the Work is substantially complete or substantially performed as defined in the Lien Act, the Work or a substantial part of it is ready for use or is being used in the way that was intended for the purpose intended, and the Engineer has issued a certificate verifying that, in the opinion of the Engineer, Substantial Performance of the Work has been achieved.

"**Superintendent**" means the Contractor's senior representative at the Project Site.

"**Supplier**" means a Person having a direct contract with the Contractor to Supply Materials not worked to a special design for the Work.

"**Supply**" means supply and pay for.

"**Surety**" means the Person who has supplied the performance and labour and material bonds for the Contract.

"**Temporary Work**" means temporary supports, structures, facilities, services and other temporary items, excluding Construction Equipment that is required for performing the Work but is not incorporated into the Work.

"**Total Performance of the Work"** means the Work, with the exception of Warranty Work, has been fully completed, including rectification of all known Deficiencies, and the Engineer has issued a certificate verifying that, in the opinion of the Engineer, Total Performance of the Work has been achieved.

"**Toxic or Hazardous Substances**" means any solid, liquid, gaseous, thermal or electromagnetic irritant or contaminant and includes all pollutants and hazardous substances or wastes whether or not defined in any Law.

"**Warranty Period**" means that period of time set out in GC 63 WARRANTY during which the Contractor is obligated to warrant the Work.

"**Warranty Work**" means the Work to remedy, correct or rectify any Deficiencies, including any Work required to access the Deficiencies and any Work required to make good the Deficiencies and any other Work or work performed by Other Contractors that is destroyed, disturbed or negatively affected by the performance of the Work to remedy, correct or rectify any Deficiencies, which shall be performed by the Contractor.

"**Work**" means and includes anything and everything required to be done for the fulfilment and completion of the Contract.

"**Workers Compensation Legislation**" means the applicable workers compensation legislation at the Project Site, current at the date of the Notice to Proceed and as may be revised during the Contract Time.

"**Working Day**" means any day that there is construction activity at the Project Site or any Business Day that construction activity is reasonably possible.

1.2 GC 2. INTERPRETATION AND GENERAL PROVISIONS

.1 Wherever this Contract requires an action to be performed or an obligation to be undertaken, unless otherwise specified, such action or obligation shall be performed in a prompt and commercially reasonable manner by the Party taking the action or fulfilling its obligation.

.2 This Contract supersedes all prior negotiations and Pre-Contractual Statements, relating in any manner to the subject matter of this Contract, including any bid documents that are not expressly listed in the Table of Contents of the Contract Documents.

.3 A Party shall have no right of action against any other Party arising out of or in connection with any Pre-Contractual Statement except to the extent that it is repeated in the Contract.

.4 This Contract may only be amended by a document in writing signed by the Parties.

.5 Wherever the term "including" is used, or any derivative thereof, it shall be read to mean "including, but not limited to" or an equivalent phrase for a derivative, as the case may be, if the context so permits such a construction.

.6 Wherever the singular or masculine or neuter is used it will be interpreted as meaning the plural or feminine or body politic or corporate, and *vice versa*, as the context requires.

.7 Documents comprising this Contract are complementary, and what is required by any one shall be as binding as if required by all.

.8 Words and abbreviations that have customary technical or trade meanings are used in this Contract in accordance with such recognized meanings.

.9 The failure of Owner, the Engineer or the Contractor at any time to require the performance of any provision or requirement of this Contract shall not affect the right of that Party to require the subsequent performance of that provision or requirement.

.10 All amounts referred to in this Contract are in Canadian dollars, unless otherwise indicated.

.11 In the calculation of time, the first day shall be excluded and the last day shall be included.

.12 If a court of competent jurisdiction determines that any provision of this Contract is invalid or unenforceable, such determination shall not affect the validity or enforceability of the remaining provisions of this Contract.

.13 The Parties have each had the opportunity of obtaining legal advice and accordingly any rule of construction to the effect that any ambiguity is to be resolved against the drafting Party shall not apply in the interpretation of this Contract.

1.3 GC 3. LAW OF THE CONTRACT AND ATTORNMENT

.1 This Contract shall be governed by the Laws of the Province or Territory where the Project Site is located and the Parties agree to attorn to the exclusive jurisdiction of the Courts of that Province or Territory.

1.4 GC 4. PRECEDENCE OF DOCUMENT FOR INTERPRETATION

.1 In case of any inconsistency or conflict between the provisions of the Contract Documents, the provisions of such documents and addenda thereto shall take precedence and govern in the following order:

1. Contract Agreement
2. Supplementary Conditions
3. General Conditions
4. Specifications
5. Drawings
6. Executed Bid Form
7. Instructions to Bidders
8. Invitation to Bid
9. All other documents

.2 Figured dimensions on a Drawing take precedence over measurements scaled from the Drawing.

.3 Large-scale Drawings take precedence over those of smaller scale.

.4 Supplementary Drawings and Specifications supersede their antecedents.

.5 In case of conflict between figured dimensions on a Drawing and the dimensions of a specified product, the dimensions of the specified product shall govern.

.6 If compliance with two or more standards or specifications is specified and the standards or specifications establish different or conflicting requirements, the Contractor shall comply with the most stringent requirement.

.7 Documents of a later date shall govern over a similar type of document of an earlier date.

1.5 GC 5. USE OF THE CONTRACT DOCUMENTS

.1 The intent of the Contract Documents is that the Contractor shall Supply, directly or through a Subcontractor, all labour, Materials, related services, equipment or other matters or things necessary for the Contractor to perform the Work.

.2 All Work described in the Specifications and not shown on the Drawings and all Work shown on the Drawings and not described in the Specifications shall be performed by the Contractor as if included in both.

.3 The Contractor shall review the Contract Documents provided by the Owner or the Engineer and shall promptly provide Notice to the Engineer of any of the following that the Contractor discovers or becomes aware of:

(a) any errors, inconsistencies, omissions or ambiguities in the Contract Documents;

(b) doubt as to the meaning or intent of any part of the Contract Documents;

(c) any variance between the content of the Contract Documents and the Law; or

(d) modifications required to be made to the Contract Documents as a result of revisions made to the Law.

.4 If the Contractor does discover any conditions described in GC 5.3, the Contractor shall not proceed with the Work affected until the Contractor has received clarification of or revisions to the Contract Documents from the Engineer.

.5 If Notice is given by the Contractor in accordance with GC 5.3 and clarifications or revisions to the Contract Documents are required, the Engineer shall revise the Contract Documents and any Change shall be dealt with in accordance with PART 11 CHANGES AND CONCEALED OR UNKNOWN CONDITIONS.

.6 If the Contractor fails to provide Notice as required in GC 5.3 or proceeds with the Work before receiving clarification of or revisions to the Contract Documents from the Engineer as provided for in GC 5.5, the Contractor shall be responsible for and shall bear the costs, expenses, and damages attributable to any such failure, or of proceeding in such manner.

.7 Unless otherwise expressly agreed to in writing by the Owner, nothing contained in the Contract Documents shall create any contractual relationship between:

(a) the Owner or its Personnel and any Subcontractor or its Personnel, or other Persons engaged in the performance of the Work; or

(b) the Engineer or its Personnel and the Contractor, or any Subcontractor, or their respective Personnel, or other Persons engaged by them in the performance of the Work.

1.6 GC 6. NO WAIVER

.1 No action or failure to act by the Owner, the Engineer or the Contractor shall constitute a waiver of any right or duty afforded or imposed on any of them under this Contract, and such action or

failure to act shall not constitute an approval of, or acquiescence in, any breach of this Contract, except as may be expressly provided for or required by this Contract or otherwise agreed in writing by the Parties.

1.7 GC 7. NO ASSIGNMENT WITHOUT CONSENT

.1 Neither Party to this Contract shall assign their respective rights or responsibilities, or any portion thereof, without the prior written consent of the other Party.

1.8 GC 8. SURVIVAL

.1 Any provision of this Contract which expressly states or naturally implies that it survives the termination, cancellation, completion, suspension or expiration of this Contract, including any other provision that is necessary for the interpretation or enforcement of the same, shall continue as valid and enforceable notwithstanding any such termination, cancellation, completion, suspension or expiration.

Part 2 PART 2 INSURANCE, WORKERS' COMPENSATION AND BONDS

2.1 GC 9. INSURANCE

.1 The Contractor shall obtain and continuously carry, while the Work is being performed and while any remedial or Warranty Work is being undertaken, at the Contractor's own expense and cost, the insurance coverage as specified in Section 00 73 16 – Insurance, unless otherwise indicated in writing by the Owner. The Owner reserves the right to supplement or add insurance coverage from time to time as may be required, by Change Order.

.2 The insurance maintained by the Owner or the Contractor shall in no manner limit the Contractor's obligations to indemnify or otherwise perform the obligations required of it pursuant to the terms of this Contract.

.3 Prior to commencing the Work, the Contractor shall provide the Owner with Certificates of Insurance in a form acceptable to the Owner and evidence the insurance coverage is in accordance with the requirements of the Contract.

.4 Deductibles, if any, which are applicable to the specified insurance, shall be borne by the Contractor.

2.2 GC 10. WORKERS' COMPENSATION

.1 The Contractor shall ensure all of its and the Subcontractors' respective Personnel, agents, representatives and visitors attending at the Project Site are registered for workers' compensation coverage. The Contractor shall indemnify and save harmless the Owner for any and all claims incurred by the Owner as a result of the Contractor failing to comply with GC 10.

.2 The Contractor shall at all times pay or cause to be paid any assessment or contribution required to be paid pursuant to the Workers Compensation Legislation applicable to the Project Site. If the Contractor fails to do so, the Owner, in addition to any of its other rights under this Contract, may

retain the amount of the assessment or contribution from any payment then due, or to become due, to the Contractor under this Contract.

.3 At any time during the term of this Contract, when requested by the Owner, the Contractor shall provide evidence of compliance by the Contractor and Subcontractors with the obligations under GC 10. As minimum, the Contractor shall provide evidence, satisfactory to the Engineer, of compliance with the requirements of the Workers Compensation Legislation including payments due thereunder at the following times:

(a) prior to commencing the Work;

(b) as a condition of receiving a Certificate of Substantial Performance; and

(c) as a condition of receiving a Certificate of Total Performance.

.4 If at any time the performance of the Work is stopped because the Contractor unreasonably fails or refuses to comply with a regulation or order issued pursuant to the Workers Compensation Legislation, then such failure or refusal shall be considered a default under this Contract and the provisions of GC 49 OWNER'S RIGHT TO TERMINATE FOR DEFAULT shall apply.

2.3 GC 11. BONDS

.1 The Contractor shall, prior to commencement of the Work, pay for and provide to the Owner:

(a) a performance bond, in the amount of 50% of Contract Price, covering the performance of this Contract, including any warranty requirements; and

(b) a labour and material payment bond, in the amount of 50% of Contract Price.

.2 The Owner shall not be obligated to make any payment to the Contractor until such time as the bonds specified in GC 11.1 have been delivered to the Owner by the Contractor.

.3 The bonds specified in GC 11.1 shall be:

(a) in the form which is in accordance with the latest edition of the CCDC approved bond forms;

(b) issued by a duly licensed surety company authorized to transact the business of suretyship in the province or territory of the Project Site;

(c) acceptable to the Owner; and

(d) maintained in good standing until the fulfillment of the Contract.

Part 3 PART 3 GENERAL PROVISIONS

3.1 GC 12. EXECUTION OF THE CONTRACT AGREEMENT

.1 The Contractor shall deliver the following documents to the Engineer within ten (10) Business Days of the date of the Notice of Award:

(a) Certificates of Insurance in accordance with GC 9 INSURANCE;

(b) evidence of compliance with the requirements of the Workers Compensation Legislation including payments due thereunder in accordance with GC 10 WORKERS' COMPENSATION;

(c) bonds in accordance with GC 11 BONDS; and

(d) draft Construction Schedule in accordance with GC 25 CONSTRUCTION SCHEDULE.

.2 The Engineer shall deliver the Contract Documents in a form ready for signing to the Contractor within ten (10) Business Days after receipt of the documents from the Contractor provided for in GC12.1 that are satisfactory and in strict compliance with the Contract Documents.

.3 The Contractor shall sign the Contract Documents and return them to the Engineer within five (5) Business Days after receiving them and the Engineer shall forward them to the Owner for signing.

.4 The Owner shall sign the Contract Documents and return them to the Engineer within fifteen (15) Business Days after receiving them and the Engineer shall deliver the Contractor's copies to the Contractor.

3.2 GC 13. CONDUCT OF THE WORK

.1 The Contractor shall perform the Work in strict accordance with the Contract Documents and in a professional, competent and safe manner with good workmanship which performance meets or exceeds the standards for construction on projects of a similar nature and locality.

.2 The Contractor shall perform the Work diligently and take all measures necessary to ensure that the Construction Schedule is met.

.3 The Contractor represents that it is highly knowledgeable and experienced in the type of work described in the Contract Documents. The Contractor is being retained by the Owner specifically because of its knowledge and expertise in that regard.

.4 The Contractor shall in all respects be an independent contractor.

.5 The Contractor shall not, in the performance of the Work, engage in practices which conflict with the Owner's interest including, without limitation, disclosing information about the Owner's business or operations; withholding information that could adversely affect the business interests or operations of the Owner; accepting gifts from or offering gifts to the Owner's Personnel that may lead to a perceived obligation; or engaging in any activity that would contravene any Law. The Contractor shall inform the Owner, immediately and in writing, of any potential conflict of interest that may arise.

.6 The Contractor shall cooperate and work with any Other Contractors, who are appointed by the Owner from time to time.

.7 The Contractor shall perform the Work in such manner as to cause a minimum of interference with the Owner's operations and the operations of Other Contractors. The Contractor and the Owner shall cooperate fully with each other, Other Contractors and all other parties with whom the Contractor and the Owner may be involved during the performance of the Work.

3.3 GC 14. ACTIVITIES

.1 The Owner will provide the Project Site. Where Work is to be performed on lands owned by others, the Owner will obtain the necessary easements or rights-of-way. Delay in providing the Project Site, or in obtaining easements or rights-of-way which, in the opinion of the Engineer, delays the Work will be deemed cause for extension of the Contract Time and the provisions of GC 47 DELAY shall apply.

.2 The Contractor will commence and proceed actively with the Work under the Contract immediately within five (5) Business Days of receipt of the Notice to Proceed. The Contractor shall not enter on the Project Site until the Owner or the Engineer has issued the Notice to Proceed.

.3 The Contractor shall ensure that all permits, licenses and building occupancy permits for the Project which are required by the Contract Documents to be obtained by the Contractor are obtained in a timely manner and in accordance with the Construction Schedule.

.4 The Contractor shall, by personal inspection, examination, calculations or tests, or by any other means, satisfy himself with respect to the local conditions to be encountered and the Quantities, quality, and practicability of the Work and of his methods of procedure.

.5 The Contractor shall be responsible for all ordering, scheduling and planning required to complete the Work in a timely manner. Without prejudice to Contractor's obligation to perform on time, the Contractor shall give the Engineer prompt Notice in writing if any delay is foreseen for any reason.

.6 The Contractor shall monitor its progress in performing the Work and report regularly to the Engineer in a format acceptable to the Engineer, which shall include:

(a) actual progress reports, with itemization of Work complete, in progress and scheduled for the next period and the Materials delivered to the Project Site;

(b) forecasts for progress and labour deployment;

(c) identification of any portions of the Work which have, or have the potential to be, delayed and the mitigation efforts being deployed by the Contractor to address such delay or potential delay;

(d) lost time incident reports; and

(e) other reports which may be requested by the Engineer from time to time.

.7 The Owner shall make reasonable efforts to provide the Contractor with the necessary information regarding the Project which the Owner has available. It shall be the Contractor's responsibility to:

(a) advise the Engineer if any further or additional information is required; and

(b) obtain and assemble adequate information to permit the Work to be completed in a proper and expeditious manner as required by and in accordance with the Contract Documents and the Construction Schedule.

Part 4 PART 4 ADMINISTRATION OF THE CONTRACT

4.1 GC 15. AUTHORITY OF THE ENGINEER

.1 The Engineer shall have authority to act on behalf of the Owner only to the extent provided for in this Contract or as the Owner may authorize, from time to time, but only to the extent that such authorization is communicated to the Contractor by Notice from the Owner.

.2 The duties, responsibilities, and limitations of authority of the Engineer shall only be modified or extended by a Notice issued by the Owner to the Contractor.

4.2 GC 16. ROLE AND RESPONSIBILITY OF THE ENGINEER

.1 The Engineer shall, to the extent specifically provided for in this Contract, be a representative of the Owner during the performance of the Work until the date of the Total Performance of the Work and the completion of the Warranty Work. The Engineer's instructions to the Contractor shall be forwarded directly from the Engineer, or alternatively through the Owner, as may be determined appropriate by the Owner from time to time.

.2 The Engineer shall visit the Project Site at intervals appropriate to the progress of the Work to observe the progress and quality of the Work and to determine if the Work is proceeding in general conformity with this Contract.

.3 The Engineer may provide at the Project Site one or more Personnel to assist in carrying out the Engineer's responsibilities.

.4 Based upon the Engineer's observations and evaluation of the Contractor's applications for payment, the Engineer shall make an assessment as to the amounts owing to the Contractor under this Contract and shall issue Payment Certificates as provided for in PART 7 PAYMENT AND ALLOWANCES.

.5 The Engineer shall not be responsible for, and shall not have control, charge, or supervision of construction means, methods, techniques, sequences, or procedures, quality assurance or safety or environmental protection programs and other programs required in connection with the Work in accordance with applicable Law or general construction practice.

.6 The Engineer shall not be responsible for the Contractor's failure to carry out its obligations in accordance with the Contract Documents. The Engineer shall not have control over, charge of, or be responsible for the acts or omissions of the Contractor or any Person for whom the Contractor is responsible at Law.

.7 The Engineer shall be, in the first instance, the interpreter of the requirements of this Contract and shall make determinations as to the performance under the Contract by the Owner and the Contractor and the Subcontractors. Interpretations and determinations of the Engineer shall be consistent with the intent of the Contract Documents.

.8 Claims, Disputes, and other matters in question relating to the performance of the Work or the interpretation of the Contract Documents, shall be referred initially by Notice to the Engineer for the Engineer's interpretation and determination. The Engineer's interpretation and determinations shall be given by Notice to both the Owner and the Contractor.

.9 The Engineer shall have authority to reject work which, in the Engineer's opinion, does not conform to the requirements of this Contract. Whenever the Engineer considers it necessary or advisable, the Engineer shall have authority to require inspection or testing of Work, whether or not such Work is fabricated, installed or completed. However, neither the authority of the Engineer to act, nor any decision either to exercise or not exercise such authority, shall give rise to any duty or responsibility of the Engineer to the Contractor.

.10 During the progress of the Work, the Engineer may issue Construction Memos to the Contractor. The Contractor shall comply with the Construction Memos with reasonable promptness or in accordance with a schedule for implementation of such Construction Memos agreed to by the Engineer and the Contractor.

.11 The Engineer may issue Field Instructions requiring the Contractor's immediate action to effect, maintain or restore compliance of the Work with the safety or environmental requirements of the Contract.

.12 The Engineer shall review and take appropriate action upon the Contractor's submittals such as Shop Drawings and samples, as provided in the GC31 SHOP DRAWINGS.

.13 The Engineer shall prepare Change Orders, Change Directives, and Contemplated Change Notices as provided in PART 11 CHANGES AND CONCEALED OR UNKNOWN CONDITIONS. Neither a Change Order nor a Change Directive shall constitute a Change unless signed by the Owner.

.14 The Engineer shall conduct reviews of the Work to verify Substantial Performance of the Work and Total Performance of the Work as provided in GC 40 SUBSTANTIAL PERFORMANCE OF THE WORK and GC 42 TOTAL PERFORMANCE OF THE WORK AND FINAL PAYMENT.

.15 The Engineer shall make reasonable efforts to promptly review and take appropriate action with respect to documents submitted by the Contractor, including written warranties and related documents, and upon the Owner's request, shall establish a process for the Owner's review of some or all such documents.

.16 In the event that the Contractor believes that the Engineer is not promptly reviewing or taking appropriate action with respect to any samples or documents submitted by the Contractor, the Contractor shall, within five (5) Business Days of such event occurring, provide Notice to the Engineer and the Owner setting out which samples or documents have not been promptly reviewed or in relation to which the Engineer has not taken appropriate action and the effect of such conduct. If the Contractor does not provide such Notice within the specified time, the

Contractor shall have no Claim against the Owner for any reason relating to the conduct of the Engineer with respect to the review of samples or documents submitted by the Contractor.

4.3 GC 17. REVIEW AND INSPECTION OF THE WORK

.1 The Owner and the Engineer shall have access to the Work at all times provided they follow the Contractor's safety requirements.

.2 The Contractor shall Supply sufficient, safe, and proper facilities at all times for the review and inspection of the Work by the Owner, the Engineer and Governmental Authorities. If parts of the Work are in preparation at locations other than the Project Site, the Owner and the Engineer shall be given access to such parts of the Work.

.3 The Owner may review the Project Site at any time to observe whether the Contractor is fulfilling its responsibilities as Prime Contractor for Safety and under the OH&S Legislation. Reviews may include: Project Site conditions, work processes, procedures and documentation of Project Site safety related activities. Observed infractions or possible infractions will be reported to the Engineer and the Contractor for further investigation and action by the Contractor.

.4 If any portion of the Work is designated for tests, inspections or approvals in the Contract Documents, or by the Engineer, or by Law, the Contractor shall give the Engineer Notice of not less than five (5) Business Days of when the Work will be ready for review and inspection. The Contractor shall arrange for, and shall give the Engineer reasonable Notice of, the date and time of inspections by all Governmental Authorities.

.5 The Contractor shall promptly deliver to the Engineer two copies of any certificates and inspection reports relating to the Work, or any portion thereof.

.6 Within ten (10) Business Days of the commencement of the Work, the Owner and the Engineer, in conjunction with the Contractor, shall jointly develop a schedule of items of Work which are designated for special tests, inspections, or approvals.

.7 If the Contractor covers or permits to be covered, Work that has been designated for special tests, inspections, or approvals before such special tests, inspections, or approvals are made, given or completed, the Contractor shall, if so directed, uncover such Work, have the inspections or tests satisfactorily completed, and re-perform all covering Work, all at the Contractor's expense, regardless of the outcome of the tests.

.8 The Engineer may order any portion or portions of the Work to be examined to confirm the Work is in accordance with the requirements of this Contract. If the Engineer provides Notice to the Contractor that the Work is not in accordance with the requirements of this Contract, the Contractor shall correct the Work and pay the cost of examination, correction and restoration. If, on such examination, the Work has been completed in accordance with the requirements of this Contract, the Owner shall be responsible for the cost of examination and restoration, except as provided for in GC 17.7.

.9 Neither the failure of the Engineer, or an inspection agency appointed by the Owner or the Engineer, to carry out any reviews or inspections, nor errors or omissions in the performance of such reviews and inspections by the Engineer, or an appointed inspection agency, shall relieve the Contractor from responsibility that the Work, or any portion thereof, is performed in accordance with this Contract.

.10 The Contractor shall continuously monitor and inspect the Work of the Subcontractors for Deficiencies and ensure that all such Deficiencies are promptly corrected.

.11 The Contractor shall implement and follow a quality assurance program with respect to the performance of the Work, and shall ensure the compliance of the Subcontractors with its quality assurance program, to ensure that the quality of the Work meets or exceeds the standards of performance and quality required by this Contract.

4.4 GC 18. DEFICIENCIES

.1 At all times during the performance of the Work, the Contractor shall promptly remedy, correct and rectify any Deficiencies, whether or not the Deficiencies have been incorporated in the Work, and whether or not the Deficiencies are the result of poor workmanship, use of defective Materials, or vandalism, theft or damage through carelessness, negligence, inadequate security or protection or other act or omission of the Contractor or any Person for whom the Contractor is responsible at Law.

.2 The Contractor shall remedy, correct and rectify, as required to ensure the timely performance of the Work in accordance with the Construction Schedule, any and all:

(a) Deficiencies in a manner acceptable to the Engineer and the Owner; and

(b) Work, or other work, that is destroyed or damaged as a result of the Deficiencies or the remedying or correction thereof.

.3 If, in the opinion of the Owner, it is not expedient to correct any Deficiency as provided for in this Contract, after consultation with the Engineer and Contractor, the Owner may require the Contractor to deduct from the amount otherwise due to the Contractor the difference in value between the Work as performed and that called for by this Contract. If the Owner and the Contractor do not agree on the difference in value, they shall refer the matter for determination in accordance with PART 12 DISPUTE RESOLUTION.

.4 In the event that the Contractor does not remedy, correct or rectify the Deficiencies as required herein, the Owner may, upon expiry of ten (10) Business Days after giving Notice to the Contractor, take such steps as may be necessary to remedy, correct or rectify the Deficiencies in the Work or other work which is damaged or destroyed as a result of the Deficiencies or the remedying or correction thereof. In such event, the Contractor shall promptly pay the Owner for costs incurred by the Owner for remedying, correction or rectification of those Deficiencies, including both the Work or other work, if any, destroyed or damaged, or any alterations necessitated by the Contractor failing to remedy, correct or rectify the Deficiencies and any claims incurred by the Owner in so doing may be set-off against any monies due from the Owner to the Contractor.

Part 5 PART 5 EXECUTION OF THE WORK

5.1 GC 19. CONTROL OF THE WORK

.1 The Contractor shall have total control of the Work and shall effectively control, direct and supervise the Work so as to ensure conformity with the Contract Documents and compliance with all Law.

.2 The Contractor shall be solely responsible for construction means, methods, techniques, sequences, procedures and safety and coordination of the various parts of the Work.

.3 Without limiting the generality of the foregoing, the Contractor is responsible for the coordination of the various parts of the Work so that no part is left in an unfinished or incomplete condition, unless otherwise required or specified by the Engineer to be unfinished or uncompleted.

.4 Prior to commencing any of the Work, the Contractor shall verify all measurements, dimensions, and levels necessary for the proper, timely and complete performance of all aspects of the Work. Where measurements, dimensions or levels are not included in the Contract Documents or exact locations or requirements are not apparent, the Contractor shall immediately provide Notice to the Engineer identifying the lack of information and shall obtain instructions from the Engineer prior to proceeding with any part of the Work affected thereby.

5.2 GC 20. ELECTRONIC INFORMATION

.1 At the Contractor's request and at the Owner's option, the Engineer may provide the Contractor with electronic copies of the Drawings, design digital terrain model, building information model or other such information.

.2 If the Engineer does provide such information, it is provided "as is" and at the Contractor's request, without warranty of any kind, whether expressed or implied. All implied warranties, including, without limitation, implied warranties of accuracy, completeness, merchantability, fitness for a particular purpose, and non-infringement, are hereby expressly disclaimed. Under no circumstances will the Owner or Engineer, its officers, directors, employees, Consultant, sub-consultants and agents be liable to any person or business entity for any direct, indirect, special, incidental, consequential, or other damages based on any use of this information or any information referenced therein, including, without limitation, any lost profits, business interruption, or loss of programs or information, even if Associated Engineering has been specifically advised of the possibility of such damages.

.3 Under no circumstances will the Owner or the Engineer be liable to any Person for any direct, indirect, special, incidental, or other damages including Consequential Damages and, without limitation, any loss of programs or information, based on any use of this information or any information referenced therein, even if the Owner or the Engineer has been specifically advised of the possibility of such damages.

.4 The Contractor agrees, to the fullest extent permitted by law, to defend, hold harmless and indemnify the Owner and their consultants, and each of their officers, employees, and affiliated and successor companies from and against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees, whether asserted as a breach of contract, breach of warranty, negligence, misrepresentation or other tort, or otherwise, arising out of or in any way connected with the use, conversion, modification, misinterpretation, misuse, or reuse by the

Contractor or others for whom the Contractor is responsible of the Electronic Data provided by the Owner.

.5 The Contractor agrees not to reverse-engineer, or use in any way, the BIM or its contents (including Revit families or objects) provided by the Owner, except to use specifically for this project and only for the uses described herein. Recipient will not export or share the Electronic Data or any unique or novel aspects of the Consultants model(s) or BIM process with any third party, in full or in part, for any reason other than to fulfill the project requirements by the Contractor for the Owner.

.6 The Contractor agrees to require its subcontractors who use any of the Electronic Data to the terms of Section 5.2.

5.3 GC 21. LAYOUT OF THE WORK

.1 The Engineer shall establish reference points for construction which are necessary for the Contractor to proceed with the Work.

.2 The Contractor shall preserve and protect the established reference points and shall not modify or relocate the established reference points without the approval of the Engineer.

.3 Unless otherwise stated in the Contract Documents, the Contractor shall be responsible for:

(a) laying out the Work;

(b) Supply of stakes, markers and related tools and equipment.

.4 Regardless of the layout methodology, the Contractor shall verify the accuracy of the proposed location of the elements of the Work as indicated by the layout, prior to their construction, by measurements to legal property lines and existing physical features at the Project Site.

5.4 GC 22. CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS

.1 The Owner reserves the right to award separate contracts for work at the Project Site to Other Contractors and to perform work with its own forces.

.2 The Contractor shall cooperate and work with any Other Contractors, who are appointed by the Owner from time to time.

.3 When separate contracts are awarded by the Owner to Other Contractors for work at the Project Site, the Owner shall:

(a) provide for the coordination of the activities and work of Other Contractors with the Work;

(b) provide Notice to the Contractor as to whether the Contractor will be Prime Contractor for Safety in relation to some, or all of the work that is performed by Other Contractors; and

(c) where the Contractor is Prime Contractor for Safety for the area of the Project Site where work is to be performed by Other Contractors, contractually require that those Other

Contractors adhere to the work rules and procedures established by the Contractor to ensure safety and the protection of Persons and the Work.

.4 When separate contracts are awarded for work at the Project Site or when work is performed at the Project Site by the Owner's own forces, the Contractor shall:

(a) provide the Other Contractors with a reasonable opportunity to bring onto the Project Site and store their respective materials and to use their construction equipment and temporary work to execute their respective work;

(b) coordinate and schedule the Work with the work of Other Contractors;

(c) connect such other work with the Work as specified or shown in the Contract Documents;

(d) participate and assist with Other Contractors and the Owner in reviewing and coordinating the construction schedules of those Other Contractors; and

(e) where part of the Work is affected by, or depends upon for its proper execution, the work of Other Contractors, promptly provide Notice to the Engineer, prior to proceeding with that part of the Work, of any apparent deficiencies in such work. Failure by the Contractor to promptly provide Notice will invalidate any Claims of the Contractor against the Owner by reason of the deficiencies in the work of Other Contractors.

.5 When a Change is required as a result of:

(a) assignment of Prime Contractor for Safety status by the Owner with respect to Other Contractors; or

(b) coordination of, interference or damage to the work of Other Contractors; or

(c) connection of the work of Other Contractors with the Work,

the Changes will be dealt with in accordance with PART 11 CHANGES AND CONCEALED OR UNKNOWN CONDITIONS.

5.5 GC 23. SUSPENSION OF WORK BY OWNER

.1 The Owner may at any time suspend the Work or delay commencement thereof, or any portion thereof, provided he gives the Contractor ten (10) Business Days' Notice of suspension or delayed commencement. The Contractor shall resume Work upon Notice from the Owner within ten (10) Business Days after the date set forth in such Notice to resume Work.

.2 In the event that the Owner chooses to delay the commencement of the Work or any portion thereof or implement a temporary suspension:

(a) the Contract Time shall be adjusted by the Owner to account for the period of delay or suspension affecting the Work and any seasonal impact on the Work directly resulting from the delay or suspension; and

(b) the Owner shall reimburse the Contractor for direct and provable costs and expenses incurred by the Contractor necessitated by such delay or suspension of the Work or

portion thereof, but the Contractor shall not recover from the Owner payment for any loss of profits or any other form of damages.

.3 If the delay or suspension of the Work lasts more than forty-five (45) Business Days, the Contractor may, at its option and on ten (10) Business Days' Notice, terminate the Contract as provided for in GC 50 CONTRACTOR'S RIGHT TO TERMINATE FOR DEFAULT. The Contractor shall not be permitted to terminate the Contract when only a portion of the Work is delayed or suspended.

.4 A suspension of the Work because of seasonal climatic conditions, whether ordered by the Owner or the Engineer or not, shall not be deemed to be a suspension of the Work within the meaning of GC 23.

.5 Except as provided by GC 23, the Owner shall not be liable in any way to the Contractor in relation to a suspension or delayed commencement of the Work, or any portion of the Work, and under no circumstances shall the Owner be liable for Consequential Damages as a result of suspension or delayed commencement of the Work pursuant to GC 23.

5.6 GC 24. TEMPORARY SUPPORTS, STRUCTURES AND FACILITIES

.1 The Contractor shall have the sole responsibility for the design, erection, operation, maintenance and removal of Temporary Work and the design and execution of construction methods required in its use.

.2 The Contractor shall engage and pay for professional engineer(s) registered and in good standing in the Province or Territory where the Project Site is located and skilled in the appropriate disciplines to perform those functions referred to in GC 24.1 where:

(a) required by the Law or by the Contract Documents; and

(b) in all cases where such Temporary Work and its method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

.3 Despite any other provision of this Contract, where the Contract Documents include designs for Temporary Work or specify a method of construction in whole or in part, such Temporary Work shall be considered to be part of the design of the Work and the Contractor shall not be held responsible for that part of the design or the specified method of construction. The Contractor shall, however, be responsible for the execution of such design or specified method of construction in the same manner as for the execution of the Work.

.4 At least fifteen (15) Business Days before construction or location of Temporary Work the Contractor shall submit representative designs and sketches of Temporary Work to the Engineer as provided for in GC 31 SHOP DRAWINGS. The Engineer shall review the Temporary Work drawings and sketches for compatibility with the Work and for possibilities of impediments to the operations of Other Contractors and the safe passage of the public.

5.7 GC 25. CONSTRUCTION SCHEDULE

.1 The Contractor shall:

(a) within ten (10) Business Days of award of this Contract, prepare a draft Construction Schedule including all of the construction phases of the Work that shall incorporate:
  (i) the sequence and timing of the required major Project decisions;
  (ii) the timing of major activities of the Work and sufficient detail of the critical events and their inter-relationship to demonstrate that the Work will be performed in conformity with the Contract Time; and

(b) within the time referred to in GC 25.1(a) deliver to the Engineer the draft Construction Schedule and:
  (i) at a time agreed to by the Engineer, make a presentation of the draft Construction schedule to the Engineer;
  (ii) where the draft Construction Schedule cannot be accepted by the Engineer without revision, the Contractor shall promptly revise the draft Construction Schedule and deliver and re-present it to the Engineer repeating the process until the draft Construction Schedule is accepted and becomes the Construction Schedule;
  (iii) break-down the Construction Schedule into phases of the Work and show the Milestone Dates for the various phases;
  (iv) use the Construction Schedule as the baseline schedule which will be identified and compared to all subsequent schedule revisions and updates;
  (v) at least monthly, or as more frequently requested by the Engineer:
    1. provide proposed updates to the Construction Schedule, which updates shall include:
      a. a monthly forecast of the planned progress of the Work;
      b. adjustments resulting from Change Orders and Change Directives; and
      c. identification of potential variances between the Construction Schedule and probable completion dates for all elements of the Work;
    2. review all schedules for Work not started or completed and when required prepare and plan for mitigation measures and submit the mitigation plan in writing to the Engineer for review.

.2 Acceptance by the Engineer of the Construction Schedule shall not diminish or lessen the Contractor's obligations and responsibilities under this Contract, including the obligation to meet the Milestone Dates and achieve the Total Performance of the Work within the Contract Time.

.3 The time for performance of the Work shall commence on the date specified in the Notice to Proceed, or if not so specified, on the date that the Notice to Proceed is issued.

5.8 GC 26. SAFETY

.1 Unless expressly directed otherwise pursuant to GC 22 CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS, the Contractor shall be solely responsible for construction safety at the Project Site and in performing the Work, and for the Contractor's compliance and that of the Subcontractors with all Law and practices relating to health and safety. The Contractor shall be responsible for initiating, maintaining and supervising all safety programs, including the preparation of applicable hazard assessments, in connection with the performance of the Work.

.2 The Owner delegates and the Contractor accepts the role and responsibilities of the Prime Contractor for Safety for the entire Project Site until the Project Takeover Date of the entire Work. A partial takeover of the Project by the Owner shall not affect this delegation, unless Notice of a Change in the designation of the Contractor as Prime Contractor for Safety is provided by the Owner to the Contractor, in which case, the Contractor shall follow the directions of the Owner as set out in the Notice.

.3 In the event of any occurrence, circumstance or condition that caused, or has the potential to cause, injury or damage to any Person, property, reputation, security or the environment, the Contractor shall:

(a) immediately verbally notify the Owner and the Engineer of the same and follow up with prompt Notice providing details of the occurrence, circumstance or condition;

(b) keep the Owner and the Engineer informed and provide copies of all relevant documentation to the Owner and the Engineer of all developments, including medical status and anticipated recovery of any individuals involved, investigations by any Governmental Authority, reports prepared by or submitted by the Contractor or any Subcontractor and the laying of any charges;

(c) cooperate and ensure the cooperation of all Subcontractors with investigations, whether instigated by the Owner or any Governmental Authority, and provide copies of any investigations undertaken by the Contractor to the Owner; and

(d) prepare a corrective action plan in a time period agreed to by the Owner and the Engineer and provide a copy to the Owner and the Engineer.

.4 The Owner may, acting reasonably but at its sole and absolute discretion, for reasons of health and safety, cause parts of, or all of, the Work or Project to be stopped, or the Contractor or any of the Subcontractors to be removed or excluded from the Project Site. Such action shall not relieve the Contractor from its obligations under this Contract or otherwise affect the Contract Price, the Contract Time or give rise to any Claim by the Contractor against the Owner.

5.9 GC 27. SUPERINTENDENT AND KEY PERSONNEL

.1 The Contractor shall assign to the Project the Superintendent identified in Section 00 45 13 – Bidder's Qualifications. The Superintendent shall remain assigned to the Project up to and including the achievement of Substantial Performance of the Work and shall dedicate substantially all of their full working time and attention to the Project. The Contractor shall ensure that the Superintendent is available at no additional cost for consultation and to provide direction during the correction of Deficiencies and performance of any Warranty Work. The Superintendent shall not be removed, re-assigned to another project or have their role changed on the Project without the prior written consent of the Engineer, unless such individual leaves the employment of the Contractor.

.2 The Superintendent shall represent the Contractor at the Project Site until all Deficiencies noted at the time of Substantial Performance of the Work have been corrected to the satisfaction of the Engineer. Notices and Construction Memos given to the Superintendent shall be held to have been received by the Contractor.

.3 The Engineer, may, with reasonable cause at any time during the performance of the Work, by Notice to the Contractor, require the replacement of the Superintendent identified in Section 00 45 13 – Bidder's Qualifications or other supervisory Personnel assigned to the Work. Upon receipt of the Notice, the Contractor shall immediately make arrangements to appoint a replacement acceptable to the Engineer.

5.10 GC 28. SUBCONTRACTORS

.1 The Contractor shall:

(a) enter into written subcontracts with Subcontractors to require them to perform their Work as provided in the Contract Documents;

(b) ensure that the relevant portions of this Contract are incorporated into and form part of, the subcontracts entered into between the Contractor and its Subcontractors, including:

(i) provisions equivalent to those set out in PART 10 TERMINATION so that in the event of any kind of termination or delay the Contractor is only required to pay its Subcontractors for those types of costs and expenses that the Owner is required to pay the Contractor and the Contractor shall indemnify the Owner from any other claim by any of its Subcontractors; and

(ii) an obligation for Subcontractors to protect the Work, the Owner's property, property on or adjacent to the Project Site and Materials stored off the Project Site on terms equal to, or more favourable, than the terms set out in PART 6 PROTECTION OF PERSONS AND PROPERTY AND TOXIC OR HAZARDOUS SUBSTANCES.

.2 The Contractor shall employ only those Subcontractors listed in Section 00 43 36 – Subcontract List or others as approved in writing by the Engineer and shall not change or employ additional Subcontractors without the approval of the Engineer and the Owner, which approval shall not be unreasonably withheld. Such changes in Subcontractors shall not result in an adjustment to the Contract Price or Contract Time.

.3 The Owner, through the Engineer, may at any time during the performance of the Work object to the use of a Subcontractor and give Notice to the Contractor to employ a different Subcontractor that is satisfactory to the Owner.

.4 If the Owner requires the Contractor to change a proposed Subcontractor or Supplier pursuant to GC 28.3 for any reason other than reasonable cause, the Contract Price or Contract Time, or both as the case may be, shall be adjusted by the differences, if any, occasioned by such required Change.

.5 Unless a Subcontractor is specified in the Contract Documents, the Contractor shall not be required to engage as a Subcontractor, a Person to whom the Contractor reasonably objects.

.6 If a Subcontractor provides the Engineer with a copy of the relevant executed subcontract agreement, then the Owner, through the Engineer, may provide to a Subcontractor information as to the percentage of the Subcontractor's Work which has been certified for payment. The Owner and the Engineer shall inform the Contractor of any such communications.

5.11 GC 29. LABOUR AND MATERIALS

.1 The Contractor shall Supply all services, labour, Materials, tools, Construction Equipment, Temporary Work, water, heat, light, power, transportation, and other facilities and services, including temporary access, access roads, parking areas, laydown areas and utilities, necessary for the performance of the Work.

.2 Materials Supplied shall be new, fit for the purposes intended by the Owner and otherwise of the quality as depicted in and required by the Contract Documents. Materials that are not specified shall be of a quality consistent with those specified and their use confirmed in advance as being acceptable to the Engineer.

.3 Materials that are used in the performance of the Work, for construction or incorporation into parts of the Work that will be in contact with partially treated or potable water, including water retaining structures and piping, shall be compatible with potable water in accordance with all applicable health and environmental regulations. This shall include, but not be limited to, all sealants, waterproofing agents, form release agents, concrete accessories, and valve and pipe coatings and linings.

.4 Until such time as the Materials are incorporated into the Work, the Contractor shall be responsible for the safe and secure storage and preservation of Materials on the Project Site, or elsewhere if located off of the Project Site, so as to avoid damage, destruction, contamination, alteration, waste or spoilage to the Materials, injury to Persons, damage or destruction to property or delay to the Project resulting from such Materials.

.5 The Contractor shall maintain good order and discipline among the Contractor's Personnel, and the Subcontractor's Personnel engaged in the performance of the Work, and shall not employ, or permit to be employed, any Subcontractor not skilled in the tasks assigned.

5.12 GC 30. DOCUMENTS AT THE SITE

.1 The Contractor shall keep at least two (2) copies of current Contract Documents, permits, licenses, authorizations, submittals, reports, the Construction Safety Plan, together with documentation applicable to safety procedures and compliance with the OH&S Legislation and Workers Compensation Legislation, and minutes of meetings for the Work at the Project Site, in good order and available for review by the Owner and the Engineer.

.2 The Contractor shall ensure that record Drawings, Project Record Drawings, maintenance manuals, operating instructions, and such similar construction documents, are properly completed and handed over to the Engineer in a timely manner, or as otherwise required by the Owner. The Contractor shall not achieve Total Performance of the Work until all record Drawings, Project Record Drawings, maintenance manuals, operating instructions and such similar construction documents are complete and delivered to the Engineer.

.3 The Contractor shall ensure that all manufacturers' maintenance manuals, service agreements, warranties and guarantees are in order, and shall prepare a register of the same and deliver the register and the documents to the Engineer in a timely manner, or as otherwise required by the Owner, and in any event, before Total Performance of the Work.

5.13 GC 31. SHOP DRAWINGS

.1 In consultation with the Engineer, the Contractor shall establish and implement procedures for timely receipt, processing and review of Shop Drawings and samples. Upon request of the Engineer, the Contractor shall prepare a target schedule of dates for submission, review and return of Shop Drawings for the consideration of the Engineer.

.2 The Contractor shall Supply Shop Drawings as described in the Contract Documents or as the Engineer may reasonably request.

.3 The Contractor shall review all Shop Drawings prior to submission to the Engineer and shall represent by its review that:

(a) the Contractor has determined and verified all field measurements and field construction conditions and shall ensure that any Subcontractor submitting Shop Drawings has also determined and verified all field measurements and field construction conditions, Material requirements, catalogue numbers, and similar data; and

(b) the Contractor and the Subcontractor have checked and coordinated all Shop Drawings with the requirements of the Work and the requirements of the Contract Documents.

.4 The Contractor shall confirm this review of each of the Shop Drawings by stamp, date, and signature of the individual responsible. Shop Drawings not reviewed, stamped and signed by the Contractor may be rejected by the Engineer.

.5 The Contractor shall submit Shop Drawings to the Engineer to review in an orderly sequence, in accordance with any schedule that may be agreed to for the submission of Shop Drawings and sufficiently in advance of the need for reviewed Shop Drawings, so as not to cause any delay to the Construction Schedule or to the work of Other Contractors. At the time of submission, the Contractor shall provide Notice to the Engineer of any deviations in the Shop Drawings from the requirements of the Contract Documents.

.6 Upon the Engineer's request, the Contractor shall revise and resubmit Shop Drawings which the Engineer rejects as inconsistent with the Contract Documents. The Contractor shall provide Notice to the Engineer of any revisions made to resubmitted Drawings other than those requested by the Engineer.

.7 If the Contractor Supplies the Shop Drawings in accordance with the schedule agreed upon, the Engineer shall review and return Shop Drawings in accordance with the schedule agreed upon, or otherwise with reasonable promptness. In the event that the Contractor believes that the Engineer is not promptly reviewing Shop Drawings submitted by the Contractor, the Contractor shall, within five (5) Business Days of such event occurring, provide Notice to the Engineer and the Owner setting out which Shop Drawings have not been promptly reviewed and the effect of such conduct. If the Contractor does not provide such Notice within the specified time, the Contractor shall have no Claim against the Owner for any reason relating to the conduct of the Engineer with respect to review of Shop Drawings.

.8 The Engineer's review of Shop Drawings is for general conformity to the design concept, and for general arrangement only, and shall not relieve the Contractor of responsibility for errors or omissions in the Shop Drawings or for meeting all requirements of this Contract.

.9 The Engineer's authority to review Shop Drawings shall be for the benefit of the Owner and such authority shall not give rise to any duty or responsibility of the Engineer or the Owner to the Contractor, Subcontractors or their Personnel or other Persons performing any of the Work.

.10 Shop Drawings that require approval of any Governmental Authority shall be submitted to such Governmental Authority by the Contractor for approval, prior to submission to the Engineer, so as not to adversely impact the Construction Schedule.

5.14 GC 32. STEWARDSHIP OF THE PROJECT SITE

.1 The Contractor shall confine Construction Equipment, Temporary Work, storage of Materials, waste products and debris and operations of Personnel and Subcontractors to limits indicated by Law, ordinances, permits or the Contract Documents, as applicable, and shall not unreasonably encumber or obstruct the Work or the Project Site.

.2 The Contractor shall not load, or permit to be loaded, any part of the Work with a weight or force or in any other manner that will endanger the safety of the Work or any Persons.

.3 The Contractor shall maintain the Work and the Project Site in a tidy condition free from the accumulation of waste products and debris, other than that resulting from the operations of the Owner or Other Contractors.

.4 The Contractor shall remove waste products and debris, other than that resulting from the operations of the Owner or Other Contractors, and shall leave the Work and the Project Site clean and suitable for occupancy on each applicable Project Takeover Date. The Contractor shall remove tools, Construction Equipment, and equipment not required for the performance of the remaining Work.

.5 In the event that any products or debris resulting from the operations of the Owner or Other Contractors affects the Work or safety on the Project Site, the Contractor shall immediately verbally inform the Engineer and the Owner and provide Notice to the same of such condition within one (1) Business Day thereafter.

.6 Prior to application for the final Payment Certificate, the Contractor shall remove tools, Construction Equipment, Temporary Work, and waste products and debris, other than that resulting from the work undertaken by the Owner or the Other Contractors.

Part 6 PART 6 PROTECTION OF PERSONS AND PROPERTY AND TOXIC OR HAZARDOUS SUBSTANCES

6.1 GC 33. PROTECTION OF WORK AND PROPERTY

.1 In performing the Work the Contractor shall protect the Work and the Owner's property and any other Person's property from damage. The Contractor shall at the Contractor's own expense make good any such damage which arises as the result of the Contractor's operations.

.2 At no additional cost to the Owner and as part of the Work, the Contractor shall provide all safety devices, signage and supervision at the Project Site that are necessary to protect Personnel and the public.

.3 Before commencing any Work at the Project Site the Contractor shall:

(a) expose and determine conclusively the location in the field of all underground utilities and structures indicated on the Contract Documents as being at the Project Site;

(b) consult with all utility corporations that provide electricity, communication, gas or other utility services in the area of the Project Site, to expose and conclusively determine the location of all underground utilities;

(c) expose and conclusively determine the location of any other utilities or underground structures that are reasonably apparent or inferable in an inspection of the Project Site; and

(d) survey and record the location, in three dimensions, of underground structures exposed in accordance with GC 33.3; and

(e) provide the information obtained under GC 33.3 (d) to the Engineer.

.4 If any underground utility or structure located under GC 33.3 is in conflict with the Work as indicated on the Drawings, immediately provide Notice to the Engineer. If the resolution of the conflict requires a Change that increases or decreases the Contract Price or the Contract Time, then the provisions of GC 57 CONCEALED OR UNKNOWN CONDITIONS shall apply.

.5 The Contractor shall pay the costs to repair any underground utility or structure that the Contractor damages in the performance of the Work which the Contractor was required to locate under GC 33.3.

.6 If, in the performance of the Work the Contractor causes damage to an underground utility or structure:

(a) which was unknown or unforeseeable to the Contractor at the time of the damage; and

(b) that the Contractor was not required to locate pursuant to GC 33.3,

then such event may be considered a concealed or unknown condition and the provisions of GC 57 CONCEALED OR UNKNOWN CONDITIONS shall apply.

.7 Unless the Owner provides Notice to the Contractor stating otherwise, in the event of a shutdown or suspension of the Work, the Contractor shall continue to be responsible for the care, protection, security and maintenance of the Work during the period of the shutdown or suspension.

.8 The Contractor shall provide, at no additional cost to the Owner, adequate site security at all times during the performance of the Work. The Owner shall not be responsible for the costs of any theft, damage, alteration, loss or replacement.

6.2 GC 34. TOXIC OR HAZARDOUS SUBSTANCES

.1 Unless otherwise specified in the Contract Documents the Contractor shall assume that the Owner has elected not to conduct tests or investigations for Toxic or Hazardous Substances at the Project Site.

.2 Subject to the provisions of GC 34, the Owner bears the risk that the Contractor will encounter Toxic or Hazardous Substances at the Project Site.

.3 The Contractor has no obligation or duty to conduct tests or investigations for Toxic or Hazardous Substances at the Project Site unless the Engineer gives written directions regarding Toxic or Hazardous Substances that are discovered or suspected at the Project Site.

.4 If, in the performance of the Work the Contractor encounters any materials at the Project Site that the Contractor knows or suspects may be Toxic or Hazardous Substances then the Contractor shall immediately:

(a) stop the Work, or portion of the Work, and take such steps as required so that such materials are contained and not disturbed; and

(b) give written Notice to the Engineer, the Owner and all other parties as required by Law.

.5 If the Engineer observes any materials at the Project Site that the Engineer knows or suspects may be Toxic or Hazardous Substances then the Engineer shall immediately give written Notice to the Owner and the Contractor, and the Contractor shall immediately stop the Work or portion of the Work as required by GC 34.4.

.6 If materials are encountered that are or are suspected to be Toxic or Hazardous Substances and Notice is given either by the Contractor pursuant to GC 34.4, or by the Engineer pursuant to GC 34.5, then the Engineer shall after consulting with the Contractor give the Contractor written directions specifying what, if any, measures are to be taken on account of such materials so as to reasonably permit the Contractor to proceed with the Work. The Contractor shall strictly comply with any such directions.

.7 The Work shall be performed in full compliance with all Laws applicable to any Toxic or Hazardous Substances encountered at the Project Site.

.8 Any adjustment that the Contractor is required to make to the performance of the Work on account of suspected or confirmed Toxic or Hazardous Substances encountered by the Contractor at the Project Site and that were not identified in the Contract Documents shall be considered a concealed or unknown condition and the provisions of GC 57 CONCEALED OR UNKNOWN CONDITIONS shall apply.

.9 Unless stated otherwise in the Contract Documents, the remediation, treatment or removal of any Toxic or Hazardous Substances shall be a Change and the provisions of Part 11 CHANGES AND CONCEALED OR UNKNOWN CONDITIONS shall apply.

.10 Provided that the Contractor strictly complies with the requirements of GC 34 then the Owner shall indemnify the Contractor against any costs, expenses and damages that the Contractor is required by Law to pay to any third party (excluding Subcontractors) as a direct result of encountering any Toxic or Hazardous Substances in the performance of the Work at the Project Site.

.11 If the Contractor fails to notice any materials that a competent contractor reasonably experienced in the Work would have noticed were Toxic or Hazardous Substances, or fails to comply with a direction given by the Engineer pursuant to GC 34.5, then the Contractor shall:

(a) pay all reasonable additional costs the Owner is required by Law to incur to deal with any Toxic or Hazardous Substances that have been disturbed or permitted to escape as a direct result of such failure; and

(b) indemnify the Owner from any and all additional costs, expenses and damages that the Owner is required by Law to pay to any third party as a direct result of such failure.

.12 The Contractor shall not bring to the Project Site any Toxic or Hazardous Substances and the Contractor shall indemnify the Owner from any costs, expenses and damages the Owner is required by Law to pay as a result of the Contractor bringing any Toxic or Hazardous Substances to the Project Site.

.13 Nothing in GC 34 shall be interpreted to prohibit or prevent the Contractor from bringing to the Project Site any Toxic or Hazardous Substances such as fuel oil, or other materials that the Contractor is specifically, or by necessary and reasonable implication, permitted or required to bring onto the Project Site in order to perform the Work as required by the Contract Documents.

.14 In the event that Toxic or Hazardous Substances are used or placed in the Work or onto the Project Site by the Contractor, or any Person for whom the Contractor is responsible at Law, the Contractor shall take the necessary steps to ensure that no Person suffers injury, sickness, or death, and that no property is damaged or destroyed as a result of exposure to, or the presence of, such Toxic or Hazardous Substances.

Part 7 PART 7 PAYMENT AND ALLOWANCES

7.1 GC 35. GENERAL PROVISIONS RELATING TO PAYMENT

.1 Payments shall be made to the Contractor in accordance with this PART 7 PAYMENT AND ALLOWANCES and, as applicable, Section 00 52 00 - Contract Agreement.

.2 No payment by the Owner under this Contract, or partial or entire use or occupancy of the Work by the Owner shall constitute an acceptance of any portion of the Work which is not in accordance with the requirements of the Contract.

7.2 GC 36. FINANCIAL INFORMATION REQUIRED OF THE CONTRACTOR

.1 At the request of the Owner, from time to time, the Contractor shall provide to the Owner, in writing, such financial or corporate information as may be reasonably required by the Owner, to establish or confirm the ability of the Contractor to perform its obligations pursuant to this Contract.

.2 The Contractor shall keep the Owner apprised of any material or significant changes in the ownership or financial position of the Contractor which take place or are to take place during the term of this Contract or which may in any manner adversely impact on the Contractor's ability to perform its obligations in a timely, competent or complete manner.

7.3 GC 37. PROGRESS PAYMENTS

.1 Within five (5) Business Days after the end of a calendar month the Engineer shall prepare and issue to the Owner a Payment Certificate for the period ending the last calendar day of the month.

.2 The Payment Certificate shall set out as of the end of last calendar day of the preceding month:

(a) the total value of the Work completed and the Materials incorporated into the Work;

(b) the total Quantities, or the percent complete for each pay item;

(c) all holdback amounts if any;

(d) the total amount owing by the Owner to the Contractor;

(e) any liquidated damages or other deductions; and

(f) set offs permitted by the Contract Documents.

.3 The Engineer shall not finalize a Payment Certificate without consulting with the Superintendent about the Quantities and amounts to be included in a Payment Certificate.

.4 The period referred to in GC 37.1 for the issuance of the Payment Certificate may be extended by any time that the Contractor takes to provide the consultation to the Engineer, or to provide any supporting documentation the Engineer requires to finalize the Payment Certificate.

.5 If the Engineer does not agree with the Superintendent regarding any aspect of the Payment Certificate then the Engineer shall without delay:

(a) prior to issuing the Payment Certificate, fully advise the Superintendent of the reasons for the disagreement; and then

(b) issue the Payment Certificate to the Owner, with a copy to the Contractor, in the amounts the Engineer determines are correct.

.6 The Contractor shall provide to the Engineer all documentation as required by the Contract Documents in support of the completed portion of the Work and Materials covered by the Payment Certificate including inspection reports, invoices, weigh tickets and daily Force Account records.

.7 If requested in writing by the Engineer the Contractor shall, as a precondition to the issuance of the Payment Certificate, provide a sworn declaration in a form acceptable to the Engineer that all amounts relating to the Work, due and owing to third parties, including all Subcontractors and Suppliers, as of the end of the month previous to that covered by the Payment Certificate, have been paid.

.8 Except for materials or products which are identified in the Contract Documents as being "Supply Only", payments shall not be made for materials or products purchased by the Contractor but not fully incorporated into the Work at the Project Site.

.9 Subject to GC 44 WITHHOLDING OF PAYMENT AND SET OFF, the Owner shall make payment to the Contractor of amounts due by the Owner no later than twenty (20) Business Days after the receipt by the Owner of the Payment Certificate as issued by the Engineer.

.10 All Payment Certificates issued by the Engineer shall be to the best of the Engineer's knowledge, information, and belief.

.11 The monthly progress Payment Certificates shall not bind the Owner or Engineer in any manner in the preparation of subsequent Payment Certificates or the final progress Payment Certificate, but shall be construed and held to be approximate only. By issuing any Payment Certificate, the Engineer does not assume any of the responsibility of the Contractor with respect to the correctness or completeness of the Work, including the Contractor's responsibility to ensure that the Work has been completed in accordance with the Contract Documents.

7.4 GC 38. PROGRESS PAYMENT HOLDBACKS

.1 The Owner shall:

(a) hold back 10%, or other percentage as required by the Lien Act, of any amounts net of value-added taxes due to the Contractor, including those amounts due for payment for Work performed after Substantial Performance of the Work; and

(b) if the Project Site is a highway, Indian reserve or other lands that cannot be liened, then, notwithstanding that a lien cannot be registered against the Project Site, hold back the percentage that would have been required if the Lien Act did apply of any amounts due to the Contractor as a lien holdback, on the same conditions as though such holdback was a requirement of the Lien Act, including making payment from such holdback directly to Subcontractors.

.2 In addition to other holdbacks as provided by the Contract Documents, the Owner may hold back from payments otherwise due to the Contractor amounts as determined by the Engineer pursuant to GC 44 WITHHOLDING OF PAYMENT AND SET OFF, on account of deficient or defective Work already paid for. This holdback may be held, without interest, until such deficiency or defect is remedied.

.3 If after Substantial Performance of the Work is achieved the Contractor is unable to complete any portion of the Work because of climatic or other conditions beyond the Contractor's reasonable control then the Owner may hold back from payments otherwise due to the Contractor the amount, as estimated by the Engineer, by which the cost to have others complete the Work exceeds the Contract Prices for such completion work.

.4 The Contractor shall assist the Owner to establish a holdback account pursuant to the Lien Act, if required to be established under the Lien Act, at a savings institution acceptable to the Owner, including preparing and completing any and all documents and forms as the savings institution may require. Any Notice issued by the Contractor upon the Owner's failure to pay into the holdback account the amount the Owner is required to retain under the Lien Act shall be given in writing to the Engineer.

7.5 GC 39. QUANTITIES

.1 The estimate of Quantities shown in Section 00 41 00 - Bid Form serves only to provide a basis for comparing bids and no representations have been made by either Owner or Engineer that the actual Quantities will even approximately correspond therewith.

.2 The Owner has the right to increase or decrease the Quantities in any or all items and to eliminate items entirely from the Work.

.3 Where there is a discrepancy between the measurement or calculations made by or for the Contractor to establish the Quantities and the measurement or calculations made by the Engineer to establish the Quantities, the Quantities shall be deemed to be the measurement made by the Engineer.

.4 Where the Quantities are disputed by the Contractor, upon request of the Contractor, the Parties will exchange their data, surveys and other information as the same relates to the measurements and calculations.

.5 If after reviewing the Engineer's data, surveys and other information the Contractor still disputes the Quantities, the Contractor may dispute the Quantities by providing Notice to the Engineer, within ten (10) Business Days of the Engineer providing its data, surveys and other information to the Contractor, stating:

(a) that it disagrees with the Quantities; and

(b) its measurements and calculation of the Quantities.

.6 If Notice is provided by the Contractor as set out in GC 39.5, the Parties shall take the necessary steps to have the Dispute resolved in accordance with PART 12 DISPUTE RESOLUTION. In the event that the Contractor does not provide Notice to the Engineer as set out in GC 39.5, the Contractor shall be deemed to have waived all of its rights to dispute the Quantities.

7.6 GC 40. SUBSTANTIAL PERFORMANCE OF THE WORK

.1 The Engineer shall be the payment certifier responsible for payment certification as required by the Lien Act for the Contractor. The Contractor shall be the Person responsible for payment certification as required by the Lien Act for all Subcontractors.

.2 When the Contractor considers that it has achieved Substantial Performance of the Work, the Contractor shall prepare and submit to the Engineer:

(a) a written application from the Contractor for a Certificate of Substantial Performance; and

(b) written confirmation that upon payment in the amount applied for, that the Contractor has no further Claim against the Owner for the Work, for any reason, except to the extent of any Claims for which the Contractor has previously provided Notice to the Owner and the Engineer.

.3 The Engineer will, no later than ten (10) Business Days after the receipt of a written application from the Contractor for a Certificate of Substantial Performance make an inspection and

assessment of the Work to verify the validity of the application. The Engineer will prepare and issue a comprehensive list of items to be completed or corrected, and either:

(a) issue the Certificate of Substantial Performance, or

(b) if the Engineer determines that Substantial Performance of the Work has not been achieved, consult with the Contractor and advise the Contractor of the Work required to achieve Substantial Performance of the Work.

.4 Failure to include an item on the comprehensive list of items described in GC 40.3 does not alter the responsibility of the Contractor to complete the Work or remedy, correct or rectify any Deficiencies.

.5 If the Engineer determines that Substantial Performance of the Work has not been achieved, the Owner may deduct the cost of the inspection and assessment by the Engineer from payments otherwise due to the Contractor.

.6 The Contractor may, after performing the required Work, re-apply for the Certificate of Substantial Performance, and the provisions of GC 40 shall apply to the re-application.

.7 The Engineer shall include the date of Substantial Performance of the Work in the Certificate of Substantial Performance.

.8 The Contractor shall promptly post a copy of the Certificate of Substantial Performance at a prominent and visible location at the Project Site.

7.7 GC 41. RELEASE OF MAJOR LIEN FUND HOLDBACK

.1 Upon the expiry of the statutory time for filing liens under the Lien Act, the Contractor shall submit the following documents to the Engineer:

(a) an application for payment of the holdback amount;

(b) a sworn declaration in a form acceptable to the Engineer to state that all accounts for labour, subcontracts, Materials, Construction Equipment, and other indebtedness which may have been incurred by the Contractor in the Substantial Performance of the Work and for which the Owner might in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified amount in dispute; and

(c) documents satisfactory to the Engineer showing compliance with the applicable Workers Compensation Legislation at the Project Site including payments due thereunder.

.2 After the receipt of an application for payment from the Contractor and the accompanying documents as provided in GC 41.1, the Engineer will issue a Payment Certificate for payment of the holdback amount.

.3 The Owner shall pay any lien holdback as required by the Lien Act, or on such other date as required by Law, but the Owner may set off from the holdback payment the amounts for any Deficiencies or filed liens as provided in GC 44 WITHHOLDING OF PAYMENT AND SET OFF.

7.8 GC 42. TOTAL PERFORMANCE OF THE WORK AND FINAL PAYMENT

.1 When the Contractor considers that it has achieved Total Performance of the Work, the Contractor shall prepare and submit to the Engineer:

(a) a written application from the Contractor for a Certificate of Total Performance; and

(b) written confirmation that upon payment in the amount applied for, that the Contractor has no further Claim against the Owner for the Work, for any reason, except to the extent of any Claims for which the Contractor has previously provided Notice to the Owner and the Engineer.

.2 The Engineer will, no later than ten (10) Business Days after the receipt of a written application from the Contractor for a Certificate of Total Performance make an inspection and assessment of the Work to verify the validity of the application, and either:

(a) issue the Certificate of Total Performance, or

(b) if the Engineer determines that Total Performance of the Work has not been achieved, the Engineer will prepare and issue a comprehensive list of items to be completed or corrected to achieve Total Performance of the Work.

.3 Failure to include an item on the comprehensive list of items described in GC 42.2(b) does not alter the responsibility of the Contractor to complete the Work or remedy, correct or rectify any Deficiencies.

.4 If the Engineer determines that Total Performance of the Work has not been achieved, the Owner may deduct the cost of the inspection and assessment by the Engineer from payments otherwise due to the Contractor.

.5 The Contractor may, after performing the required Work, re-apply for the Certificate of Total Performance, and the provisions of GC 42 shall apply to the re-application.

.6 The Engineer shall include the date of Total Performance of the Work in the Certificate of Total Performance.

.7 No later than ten (10) Business Days after issuance of the Certificate of Total Performance, the Engineer shall issue to the Contractor, a draft Payment Certificate for final payment, for the Contractor's review and agreement. If after reviewing the Engineer's Payment Certificate the Contractor disputes the Quantities or the payment amount, the provisions of GC 39 QUANTITIES will apply.

.8 If after reviewing the Engineer's Payment Certificate the Contractor agrees with the Quantities and the payment amount, then no later than five (5) Business Days after receipt from the Contractor of Notice that the Contractor agrees with the Payment Certificate for final payment, the Engineer shall issue to the Owner, a Payment Certificate for final payment in the amount that the Engineer determines to be properly due.

.9 Subject to GC 44 WITHHOLDING OF PAYMENT AND SET OFF, the Owner shall make payment to the Contractor of amounts certified as due by the Engineer, no later than twenty (20)

Business Days after receipt of the Engineer's Payment Certificate for final payment and attainment of all of the following conditions:

(a) Total Performance of the Work has been achieved by the Contractor, verified by the Engineer and approved by the Owner;

(b) the period designated for the release of holdback pursuant to the Lien Act from the date of Substantial Performance of the Work has expired;

(c) no liens have been registered arising from the Work;

(d) there are no claims that have been made against the Owner by any Person other than the Contractor, arising from the performance of the Work.

7.9 GC 43. RELEASE OF MINOR LIEN FUND HOLDBACK

.1 Upon the expiry of the statutory time for filing liens under the Lien Act, the Contractor shall submit the following documents to the Engineer:

(a) an application for payment of the holdback amount;

(b) a sworn declaration in a form acceptable to the Engineer to state that all accounts for labour, subcontracts, Materials, Construction Equipment, and other indebtedness which may have been incurred by the Contractor in the Total Performance of the Work and for which the Owner might in any way be held responsible have been paid in full, except for amounts properly retained as a holdback or as an identified amount in dispute; and

(c) documents satisfactory to the Engineer showing compliance with the applicable Workers Compensation Legislation at the Project Site including payments due thereunder.

.2 After the receipt of an application for payment from the Contractor and the accompanying documents as provided in GC 43.1, the Engineer will issue a Payment Certificate for payment of the holdback amount.

.3 The Owner shall pay any lien holdback as required by the Lien Act, or on such other date as required by Law, but the Owner may set off from the holdback payment the amounts for any Deficiencies or filed liens as provided in GC 44 WITHHOLDING OF PAYMENT AND SET OFF.

7.10 GC 44. WITHHOLDING OF PAYMENT AND SET OFF

.1 Subject to GC 44.2, if for any reason there are any Deficiencies, any portion of the Work that is not performed or there is any claim by a third party made against the Owner arising from the Work, the Owner may withhold from payment to the Contractor such amounts as the Engineer determines are sufficient and reasonable to cover the cost of rectification, completion or resolution, until the Deficiencies are rectified, the Work is completed or such claim is resolved.

.2 The cost of rectifying Deficiencies or completing Work not performed shall be estimated by the Engineer and a value equivalent to twice that amount shall be withheld from any payment. Subject to any other right the Owner may have, the holdback amount shall be paid to the Contractor after proper rectification of all the Deficiencies and completion of all Work.

.3 In preparing the estimate referred to in GC 44.2, the Engineer shall not be bound by the Contractor's unit prices and shall estimate the cost of rectifying Deficiencies or completing Work using his sole judgement of the influence of prevailing circumstances.

.4 Notwithstanding any other provision of this Contract, the Owner shall be entitled to withhold and set-off against any monies otherwise due and payable to the Contractor under this Contract, any sums which the Owner is permitted to withhold either pursuant to this Contract or to any other agreement between the Owner and the Contractor, howsoever arising.

7.11 GC 45. PROGRESSIVE RELEASE OF HOLDBACK TO SUBCONTRACTORS AND SUPPLIERS

.1 Where provided by the Lien Act and if the Contractor has certified that the work of a Subcontractor or Supplier is substantially or totally performed, upon application by the Contractor accompanied by the documents listed in GC 45.2 and expiry of the statutory time for filing liens under the Lien Act the Owner shall pay the Contractor the holdback amount retained for such subcontract work, or for the Materials supplied by such Supplier.

.2 Applications to the Engineer by the Contractor for progressive release of holdback to Subcontractors or Suppliers shall be accompanied by the following documents:

(a) A Certificate of Substantial or Total Performance of the subcontract work or supply contract, as the case may be, prepared by the Contractor in a form acceptable to the Engineer;

(b) a sworn declaration in a form acceptable to the Engineer to state that all accounts for labour, subcontracts, Materials, Construction Equipment, and other indebtedness which may have been incurred by the Subcontractor or Supplier, as the case may be, in the Substantial or Total Performance of the subcontract work, or the supply contract, as the case may be, and for which the Owner or Contractor might in any way be held responsible, have been paid in full, except for amounts properly retained as a holdback or as an identified amount in dispute;

(c) documents satisfactory to the Engineer showing compliance by the Subcontractor or Supplier, as the case may be, with the applicable Workers Compensation Legislation at the Project Site including payments due thereunder; and

(d) written confirmation that upon payment in the amount applied for, that the Subcontractor or Supplier, as the case may be, has no further Claim against the Contractor for subcontract work or Materials for any reason, except to the extent of any claims for which the Subcontractor or Supplier has previously provided Notice to the Contractor.

.3 After the receipt of an application for payment from the Contractor and the accompanying documents as provided in GC 45.2, the Engineer will issue a Payment Certificate for payment of the holdback amount.

.4 The Owner shall pay any lien holdback as required by the Lien Act, or on such other date as required by Law, or twenty (20) Business Days after receipt of the documents listed in GC 45.2 that are satisfactory to the Engineer, whichever is the latest.

.5 Progressive release of holdback to Subcontractors and Suppliers as provided for in GC 45 shall not affect the Warranty Period. The Warranty Period for the Work shall commence as provided for in GC 63 WARRANTY.

Part 8 PART 8 TAXES AND DUTIES

8.1 GC 46. RESPONSIBILITY FOR TAXES AND DUTIES

.1 The Contract Price includes all customs duties and taxes, except Goods and Services Tax (GST) or Harmonized Sales Tax (HST) or provincial sales taxes (PST), in effect at the time of the execution of this Contract.

.2 The Contractor shall be responsible to pay all taxes.

.3 The amount of GST, HST or PST payable by the Owner on goods and services provided under this Contract is in addition to the Contract Price and is to be shown on a separate line on Payment Certificates.

.4 If the Owner is exempt from GST, HST or PST, a Certificate of Exemption will be issued to the Contractor following issuance of the Notice of Award.

.5 The Contract Price shall include any tax rebates which may be applicable under current legislation. Upon request by the Contractor, the Owner shall provide certificates, in support of the Contractor's rebate submission to a Governmental Authority. The Owner shall not be liable to compensate the Contractor for any tax rebates that are denied by Governmental Authorities.

.6 In the event that new or additional duties or taxes in respect of the Work are applicable or required by the Law after this Contract is executed, the Contract Price shall be adjusted to include such new or additional taxes and duties, if applicable.

Part 9 PART 9 TIMELY CONSTRUCTION

9.1 GC 47. DELAY

.1 Subject to the limitations and requirements expressly stated in GC 47, and the Contractor's obligation to mitigate the impact of any delay, if the Contractor is delayed in the performance of the Work:

(a) due to an action or omission of the Owner, the Engineer or any Person for whom the Owner is responsible at Law;

(b) by a "stop work" or similar order issued by a court or Governmental Authority, and providing that such order was not issued as the result of an act or fault of the Contractor or any Person for whom the Contractor is responsible at Law;

(c) where Changes to the Work are made as provided for in PART 11 CHANGES AND CONCEALED OR UNKNOWN CONDITIONS;

(d) where the Work is suspended or delayed in commencement as provided for in GC 23 SUSPENSION OF WORK BY OWNER;

(e) where the Work is delayed on account of the Owner not providing the Project Site, or not obtaining easements or rights-of-way;

(f) where the Work is delayed on account of conditions which could not have been foreseen or which were beyond the control of the Contractor and which were not the result of fault or negligence of the Contractor or any Person for whom the Contractor is responsible at Law;

(g) where the Work is delayed on account of Abnormal Weather;

(h) where the Engineer causes delay in providing Drawings or necessary information;

(i) where, in the opinion of the Engineer, the Contractor is entitled to an extension of Contract Time;

(j) where strikes, lockouts, or labour disputes prevent or substantially interfere with the progress of the Work,

then provided the Engineer determines that there is no concurrent delay that has been caused by the Contractor or any Person for whom the Contractor is responsible at Law, the Contract Time shall be extended for such reasonable time as is appropriate to account for the delay directly associated with the causes set out above, but not including concurrent delays caused by the Contractor or any Person for whom the Contractor is responsible at Law, as the Engineer, in the first instance, determines, or as may be subsequently determined in accordance with PART 12 DISPUTE RESOLUTION.

.2 No extension of the Contract Time shall be made and no adjustment in the Contract Price shall be made for any delay except for a delay described in GC 47.1 and then only if the Contractor provides Notice, in accordance with GC 47.4, of such a Claim to the Engineer within five (5) Business Days after the occurrence of the event which has caused the delay.

.3 Except as expressly provided within these General Conditions, the granting of an extension of Contract Time pursuant to GC 47 shall not give the Contractor grounds to make any Claims whatsoever for additional payment, except on the grounds set out in GC 47.1 items (b), (c), (d) or (e).

.4 The Notice prescribed by GC 47.2 must:

(a) contain sufficient detail to provide the Engineer with the opportunity to identify the cause of the delay and to take steps to mitigate the impact of such delay;

(b) be provided by the Contractor to the Engineer with respect to each and every event of delay; and

(c) be provided as a separate Notice.

.5 Knowledge by the Owner or the Engineer of any delay, or the impact of any delay, shall not constitute a waiver of the requirement for the Contractor to provide Notice in accordance with GC 47.2.

.6 The failure to provide separate express Notice in strict compliance with GC 47 shall be deemed to be prejudicial to the Owner and shall prohibit the Contractor from claiming, or being entitled to, any Claim for adjustment to the Contract Time or Contract Price with respect to such delay or any impact of such delay.

.7 In the event of a delay the Contractor shall take all reasonable measures to minimize the effects and the costs of the delay and this obligation shall be taken into account in the determination of the Contractor's entitlement to an extension of the Contract Time and reimbursement of delay costs, if any.

.8 The Owner shall not be liable for any penalties or claims by third parties incurred or suffered by the Contractor and under no circumstances shall the Owner be liable for Consequential Damages, as a result of delay pursuant to GC 47.

.9 If the Contractor is delayed in the performance of the Work by its own acts or omissions or those of its Personnel or Subcontractors, then the Contractor will not be entitled to any time extension or additional payment as a result of such delay.

.10 No extension of Contract Time shall be made and no adjustment in the Contract Price shall be made for any delay Claim that is based on the concept of the cumulative effect of multiple Changes.

9.2 GC 48. LATE COMPLETION

.1 The Contractor acknowledges that if the Contractor fails to complete the Work within the Contract Time or fails to meet a specified Milestone Date for any part of the Work, the Owner will incur additional administrative and overhead costs and will be required to pay additional compensation to the Engineer (collectively "Additional Overhead"). The Contractor agrees that in the event the Contractor fails to complete the Work within the Contract Time or fails to meet a specified Milestone Date for any part of the Work, the Owner may deduct from any monies owing to the Contractor for the Work, as a genuine pre-estimate of the Owner's Additional Overhead, the amount specified in the Supplementary Conditions for each Working Day the Work or any portion of the Work remains incomplete after the applicable Contract Time or Milestone Date.

.2 The rights set out in GC 48.1 are in addition to any other rights the Owner may have and are in no way exclusive. The Contractor acknowledges that in the event no amount for Additional Overhead is specified in the Supplementary Conditions the Owner may seek to recover from the Contractor any loss and damages suffered or incurred in respect of Additional Overhead, in addition to any other claim the Owner may have at law.

.3 No bonus will be allowed by the Owner for completion of the Work in less than the Contract Time.

Part 10 PART 10 TERMINATION

10.1 GC 49. OWNER'S RIGHT TO TERMINATE FOR DEFAULT

.1 If the Contractor is unable to pay its lawful debts as they come due, is adjudged bankrupt, makes a proposal pursuant to the *Companies' Creditors Arrangement Act*, commits or threatens to do any act of bankruptcy, commits or seeks to liquidate or is involved in any similar action under any Law relating to bankruptcy or insolvency, the Owner may, without prejudice to any other right or remedy it has, terminate this Contract by giving the Contractor, trustee, monitor or receiver Notice that this Contract will be terminated immediately and that the applicable provisions of GC 49 apply.

.2 If the Contractor neglects to proceed with, undertake or complete any aspect of the Work promptly or properly, or otherwise fails to comply with the requirements of this Contract, the Owner may, without prejudice to any other right or remedy the Owner may have, give Notice to the Contractor that the Contractor is in default of the Contractor's contractual obligations and instruct the Contractor to correct the default within five (5) Business Days immediately following the receipt of the Notice.

.3 If the default cannot be corrected within the five (5) Business Days specified, the Contractor shall be in compliance with the Owner's instructions if the Contractor:

(a) commences the correction of the default in a manner acceptable to the Owner, within a different time agreed to by the Owner;

(b) provides the Owner with a written plan and schedule acceptable to the Owner for such correction; and

(c) corrects the default in accordance with such schedule.

.4 If the Contractor fails to correct the default in accordance with GC 49.2 or as subsequently agreed upon pursuant to GC 49.3, without prejudice to any other right or remedy the Owner may have, the Owner may, without further Notice to the Contractor, do one or both of the following:

(a) immediately correct such default and deduct the cost thereof, including any costs incurred by the Owner, from any payment then or thereafter due to the Contractor, provided that the Engineer has certified such cost as due to the Owner; or

(b) immediately terminate the Work, in whole or in part, or terminate this Contract, in whole or in part.

.5 In the event of default under GC 49, the Owner shall have the option, to be exercised in its absolute discretion, to terminate the right of the Contractor to perform all or any part or parts of the Work and permit the Contractor to continue to perform the rest of the Work.

.6 If the Owner terminates the Work, in whole or in part, or terminates this Contract, in whole or in part, whether pursuant to GC 49.1, GC 49.4 or GC 49.5, or otherwise:

(a) the Owner shall be entitled to take possession of the Work and Materials, and use the Construction Equipment and Temporary Work at the Project Site, subject to the rights of

third parties, and finish the Work by whatever method the Owner may consider proper or expedient;

(b) the Owner shall be entitled to withhold further payment to the Contractor until the total cost of construction of the Work and all backcharges to the Contractor are known; and

(c) in addition to any other amount that may be owing under this Contract, the Contractor shall be liable to the Owner for the amount by which the following items added together exceed the Contract Price:
  (i) the total cost of construction of the Work;
  (ii) a reasonable allowance or amount, as determined by the Engineer, to cover the cost of Warranty Work;
  (iii) a reasonable allowance or amount, as determined by the Engineer, to compensate the Engineer;
  (iv) the costs and expenses both external and internal and including actual legal fees, disbursements and taxes incurred by the Owner for its additional services related to the termination of the Work, in whole or in part, or termination of this Contract, in whole or in part.

.7 In the event that the Owner terminates the Work in part or terminates this Contract in part, the Owner shall be entitled to apply GC 49.6 with an appropriate adjustment for the portion of the Work involved and the portion of the Contract Price attributable to that portion of the Work.

.8 The Owner shall not be liable for those costs incurred by the Contractor as a result of the termination.

.9 The Owner shall not be liable for any penalties or claims by third parties incurred or suffered by the Contractor and under no circumstances shall be liable for Consequential Damages as a result of termination pursuant to GC 49 and the Contractor shall indemnify and hold the Owner and its Personnel, including the Engineer, harmless from and against any such penalties or claims.

10.2 GC 50. CONTRACTOR'S RIGHT TO TERMINATE FOR DEFAULT

.1 If the Owner is adjudged bankrupt, makes a proposal pursuant to the *Companies' Creditors Arrangement Act*, commits or threatens to do any act of bankruptcy, commits or seeks to liquidate or is involved in any similar action under any Law relating to bankruptcy or insolvency, the Contractor may, without prejudice to any other right or remedy it has, terminate this Contract by giving the Owner, trustee, monitor or receiver Notice that this Contract will be terminated immediately and that the applicable provisions of GC 50 apply.

.2 If the Work is stopped or otherwise delayed for a period of forty-five (45) Business Days or more as provided for in GC 23 SUSPENSION OF WORK BY OWNER or under an order or decision of a court or decision of another Governmental Authority, and providing that such order was not issued as the result of an act or fault of the Contractor or any Person for whom the Contractor is responsible at Law, the Contractor may terminate the Work without prejudice to any other right or remedy the Contractor may have, by giving the Owner Notice five (5) Business Days prior to such termination. The Contractor shall not be permitted to terminate the Contract when only a portion of the Work that is incomplete is delayed or suspended until forty-five (45) Business days after the Work, except for that portion which is suspended or delayed, is substantially completed.

.3 The Contractor shall provide Notice to the Owner, with a copy to the Engineer, if the Owner is in default of its contractual obligations to pay the Contractor when due the amounts certified by the Engineer or awarded by a court of competent jurisdiction. The Notice shall state that if the default is not corrected in the thirty (30) Business Days immediately following the receipt of the Notice, the Contractor may, without prejudice to any other right or remedy it may have, stop the Work or terminate this Contract.

.4 If the Contractor terminates this Contract under the conditions set out in GC 50.1 or GC 50.2, the Contractor shall be entitled to be paid for all of the Work that has been properly performed in accordance with this Contract to the date of termination and which has not been paid for or reimbursed to that date, and such other costs and expenses that the Contractor may have sustained as a direct result of the Owner's default which the Engineer considers to be reasonable and which are supported by auditable documentation, but shall not be entitled to any claims for Consequential Damages.

.5 The Owner shall not be liable for any penalties or claims incurred or suffered by the Contractor and under no circumstances shall be liable for Consequential Damages as a result of termination pursuant to GC 50 and the Contractor shall indemnify and hold the Owner and its Personnel, including the Engineer, harmless from and against any such penalties or claims.

10.3 GC 51. TERMINATION FOR CONVENIENCE

.1 The Owner, in its sole discretion, shall have the right, which may be exercised at any time, to terminate all or a portion of the Work or this Contract, without reason or cause, by giving not less than twenty (20) Business Days' Notice to the Contractor.

.2 If the Work or this Contract is terminated by the Owner pursuant to GC 51.1, the Contractor shall be entitled to:

(a) the portion of the Contract Price owed but unpaid to the date of termination, computed in accordance with this Contract; and

(b) reasonable costs incurred by the Contractor in terminating the Work or this Contract, including the cost of materials that cannot reasonably be returned to their Supplier and any return-to-supplier costs.

.3 If the Work or this Contract is terminated by the Owner pursuant to GC 51, the Owner shall not be liable to the Contractor for any claims or Consequential Damages or any amounts other than as stated in GC 51.2, as applicable, except as expressly provided for herein, and the Contractor shall indemnify and hold harmless the Owner, its Personnel, including the Engineer, from any such claims for amounts not provided for in GC 51.

10.4 GC 52. OBLIGATIONS ON TERMINATION

.1 If the Owner terminates the Work, in whole or in part, or terminates this Contract, in whole or in part, whether pursuant to GC 49.1, GC 49.4 or GC 49.5 OWNER'S RIGHT TO TERMINATE FOR DEFAULT, or otherwise, the Contractor shall:

(a) subject always to considerations of safety and of the environment, immediately discontinue performance of the Work, except to the extent as may be necessary to carry out such discontinuance, and ensure that its operations and activities are brought to an

orderly conclusion and that demobilization occurs in a proper and careful fashion with due attention being given to public safety and the protection of the Project and the Work;

(b) comply in full with the Owner's instructions regarding the termination;

(c) take such steps as may be necessary or desirable to minimize the costs to the Owner associated with the termination;

(d) promptly deliver to the Owner all of the deliverables and the Owner's Confidential Information and intellectual property, including the originals and all copies and all other documents required by the Owner;

(e) take all steps required by the Owner, to assign to and fully vest in the Owner the rights and benefits of the Contractor under all subcontracts with its Subcontractors and any licenses, warranties or guarantees for the Project; and

(f) assign to the Owner, or its nominee, as directed, rights and titles relating to all Materials for which the Contractor has been paid or will be paid through the termination process.

.2 The Contractor's obligations as to quality, correction, and warranty of the Work performed by the Contractor up to the date of termination shall continue in force after such termination. If Substantial Performance of the Work has not been reached by the date of termination, the Warranty Period shall nevertheless be deemed to commence from the date of Substantial Performance of the Work.

.3 Notwithstanding any other provision of this Contract, termination of this Contract in any manner by the Owner shall not limit, affect or invalidate in any manner:

(a) those provisions of this Contract for the benefit of the Owner which, expressly or by implication, are to operate or have effect after termination;

(b) any right of action the Owner may have as at the date of termination; or

(c) any other right or remedy the Owner may have as a consequence of the Contractor's default and the resulting termination of this Contract.

Part 11 PART 11 CHANGES AND CONCEALED OR UNKNOWN CONDITIONS

11.1 GC 53. CHANGES

.1 The Owner, through the Engineer, without invalidating this Contract, may make Changes at any time.

.2 The Contractor shall not perform a Change without a written Change Order or Change Directive signed by the Owner and issued by the Engineer.

.3 The Contractor shall advise the Engineer of the effect a Contemplated Change Notice will have on the Contract Price and the Contract Time within five (5) Business Days of receipt of the Contemplated Change Notice, or within such other time period as may be agreed by the Parties.

.4 Where both additions and deletions are involved in a Change Order all calculations for profits and overhead shall be determined on a net basis for that Change Order.

.5 The Owner shall make the final determination as to whether any Change is to be implemented.

.6 It is intended in all matters related to Changes that the Owner, the Engineer and the Contractor shall act promptly so as not to adversely impact the Construction Schedule.

.7 No further claim for change in Contract Time, Contract Price or for delay, extended schedule, direct, indirect or impact of costs, or other such claims, shall be accepted as having resulted from a Change Order after it has been accepted by the Owner.

11.2 GC 54. CONTEMPLATED CHANGE NOTICES AND CHANGE ORDERS

.1 When a Change is proposed or required, the Engineer shall provide a Contemplated Change Notice describing the proposed Change to the Contractor. If, due to exceptional circumstances, a Contemplated Change Notice cannot be issued by the Engineer, the Owner or the Engineer may issue a Change Directive as provided by GC 55 CHANGE DIRECTIVES.

.2 The method of determining the value of a Change shall be decided by the Engineer. The value of the Change shall be determined by one or more of the following methods:

(a) by unit prices or combinations of unit prices found in the "Schedule of Quantities and Prices" in Section 00 41 00 - Bid Form;

(b) by unit prices submitted by the Contractor and accepted by the Owner;

(c) by lump sum submitted by the Contractor and accepted by the Owner; and

(d) on a Force Account basis as specified in GC 56 FORCE ACCOUNT WORK.

.3 Within five (5) Business Days of receipt of the Contemplated Change Notice, or within such other time period as may be agreed by the Parties, the Contractor shall present, in a form acceptable to the Engineer, a method of proposed adjustment or an amount of proposed adjustment to the Contract Price, if any, and the adjustment in Contract Time, if any, for the proposed Change.

.4 Any written quotation for a Change submitted by the Contractor shall be interpreted:

(a) to represent the total adjustment to the Contract Price;

(b) to represent the total adjustment to the Contract Time;

(c) to include compensation for all costs related to the Change, including but not limited to costs for direct, indirect, office, overhead, surety, insurance and all other costs, mark-ups and profits; and

(d) to have considered all effects on the Contract Time and if there is no mention of Contract Time adjustment in the quotation to mean that the Contractor will implement and complete the Change without any adjustment to the Contract Time, in which case the Change will not extend the Contract Time or entitle the Contractor to additional

compensation or damages of any nature whatsoever for any scheduling issues or acceleration.

.5 In the case of Changes proposed to be paid for in whole or in part by lump sum, the Contractor shall include a cost breakdown to substantiate or justify the Contract Price adjustment, in addition to any other documentation the Engineer or the Owner may require.

.6 In the case of Changes to be paid for in whole or in part by unit rates or Force Account plus a fixed or percentage fee, the form of presentation of costs and methods of measurement shall be agreed to by the Engineer and the Contractor before proceeding with the Change. The Contractor shall keep accurate documentation of Quantities and costs for Changes, and present an account of the cost of the Change to the Engineer.

.7 When the Engineer and the Owner agree to adjustments to the Contract Price or the Contract Time, or both, and the method to be used to determine the adjustments, a Change Order signed by the Engineer, the Owner and the Contractor shall be issued revising the Contract Price or the Contract Time, or both, as applicable. The value of Work performed as the result of a Change Order shall be included in Payment Certificate.

.8 Administration of Changes to be paid for in whole or in part by Force Account plus a fixed or percentage fee, shall be in the manner set out in GC 56 FORCE ACCOUNT.

.9 The Owner reserves the right to withdraw any Contemplated Change Notice without additional compensation to the Contractor if such withdrawal occurs prior to issuance of the Change Order.

11.3 GC 55. CHANGE DIRECTIVES

.1 If the Owner requires the Contractor to proceed with a Change prior to the Owner and the Contractor agreeing upon the adjustment in Contract Price and Contract Time, the Owner, through the Engineer, may issue a Change Directive.

.2 Upon receipt of a Change Directive, the Contractor shall proceed promptly with the Change and, in the case of an emergency identified in a Change Directive, proceed immediately with the Change.

.3 An adjustment in the Contract Price for a Change carried out by way of a Change Directive shall be determined on the basis of Force Account in accordance with GC 56 FORCE ACCOUNT WORK.

.4 If the method of valuation, measurement or corresponding increase or decrease in the Contract Price and Contract Time cannot be promptly agreed upon then, the Engineer in the first instance, shall determine the method of valuation, measurement and corresponding increase or decrease in the Contract Price and the Contract Time subject to final determination in the manner set out in PART 12 DISPUTE RESOLUTION.

.5 In the case of a Dispute in the valuation of a Change Directive, and pending final determination of such value, the Engineer shall certify the value of Work performed in relation to the Change Directive in accordance with the Engineer's evaluation of the Change Directive, and shall include that amount in a progress Payment Certificate.

.6 If, at any time after the start of the Work directed by a Change Directive, the Owner and the Contractor reach agreement on the adjustment to the Contract Price and to the Contract Time, such agreement shall be recorded in a Change Order.

11.4 GC 56. FORCE ACCOUNT WORK

.1 Compensation for Work done on a Force Account basis, authorized by a Change Order or Change Directive issued by the Engineer, shall be calculated as follows:

(a) Labour - All classifications of labour not priced separately in the Bid Form will be paid for at rates actually paid by the Contractor. A payroll assessment of thirty percent (30%) of the hourly wage will be allowed to cover all costs including pension, holiday pay, payroll administration, insurance and similar benefits. Small tool allowance will be at the rate of four percent (4%) of gross cost of labour. The Contractor will be allowed a further ten percent (10%) mark-up on the total of the foregoing as the allowance for overhead and a further ten percent (10%) mark-up on the resulting subtotal as allowance for profit.

(b) Construction Equipment - The rates for equipment, vehicles and power tools shall include operator's wages, all maintenance and operating costs and Contractor's profit. No additional mark-up of Construction Equipment charges shall be allowed.

(c) Materials supplied by the Contractor shall be paid for at Supplier's invoice price plus an additional payment of ten percent (10%) of cost to cover handling and indirect overhead costs, plus ten percent (10%) of all costs including indirect overhead as profit.

(d) Construction Equipment rentals - The allowance to the Contractor for profit, superintendence, and all other expense related shall be ten percent (10%) of the rental agency's invoice to the Contractor for the rental of tools and miscellaneous equipment.

(e) For subcontract Work, the allowance to the Contractor for profit, superintendence, and all other expenses shall be ten percent (10%) of the Subcontractor's invoice for such Work performed.

.2 In the event that, in its sole discretion, Engineer deems that, any or all prices and rates for Force Account that are included in the Bid Form are not fair and reasonable compared with normal industry standards, Engineer may order recalculation of any or all prices and rates based on the Contractor's actual costs, as provided for in GC 56.1 items (a) and (b).

.3 For the purposes of calculating Force Account rates as provided for in GC 56.1 items (a) to (e), upon request by Engineer, Contractor shall submit a detailed and verifiable statement of actual cost of labour, Construction Equipment, Materials and subcontracted Work. Pending receipt of such statements, Engineer shall apply normal industry-standard Force Account rates discounted by 20% to facilitate inclusion of interim payments for Force Account in Payment Certificates, on an ongoing basis.

.4 Subcontractor's Force Account invoices to the Contractor shall be calculated and submitted for review as described in GC 56.1 items (a) to (e), unless otherwise instructed by the Engineer.

.5 On a daily basis, the Contractor shall keep an accurate, complete and up-to-date record in a form satisfactory to the Engineer, showing on a shift-by-shift basis, all Contractor and Subcontractor

labour, Construction Equipment and Materials to be paid by Force Account. Daily Force Account records shall be submitted by the Contractor to the Engineer for review within one (1) Business Day of the subject Work being performed. The submission to the Engineer or countersignature by the Engineer of daily Force Account records shall not at any time be deemed to be an admission that the Work is properly chargeable to Force Account.

.6 The Owner shall not be liable to pay for any Work based on Force Account for which the daily Force Account records were not prepared and submitted in accordance with GC 56.5.

11.5 GC 57. CONCEALED OR UNKNOWN CONDITIONS

.1 Subject to GC 57.2, should one Party discover conditions at the Project Site which:

(a) are subsurface or otherwise inaccessible and concealed physical conditions, which existed before the commencement of the Work, and which differ materially from those reasonably inferable from or indicated in the Contract Documents or studies, reports and other site data referenced therein; and

(b) materially affect the cost of the Work or the time required to perform the Work, then the discovering Party shall provide Notice to the other Party within one (1) Business Day of discovering such conditions and, in any case, before such conditions are disturbed.

.2 Physical conditions which are not visible but which are a logical extension, or part of a visible physical condition, and physical conditions which can be reasonably accessed for observation, shall not be considered as concealed for the purposes of GC 57.

.3 The Engineer shall promptly investigate and make a determination as to whether the conditions fit within the parameters described in GC 57.1.

.4 If the determination is that the conditions:

(a) fit within the parameters described in GC 57.1 and the performance of the Work with such conditions being present requires a Change that increases or decreases the Contract Price or the Contract Time, or both, then a Change Order or a Change Directive, as applicable, shall be issued to deal with the consequences of the conditions; or

(b) do not fit within the parameters described in GC 57.1 or do fit within the parameters described in GC 57.1 but do not cause an increase or decrease in the Contract Price or Contract Time, or both, the Engineer shall provide Notice of such determination to both the Owner and the Contractor.

.5 If either Party wishes to make a Claim that the Contract Time or Contract Price should be adjusted because of concealed or unknown conditions then such Party shall give the other Party and the Engineer Notice of such Claim immediately after that Party first becomes aware of the concealed or unknown condition. No adjustment of Contract Price or Contract Time shall be allowed for any Work undertaken prior to the delivery of such Notice.

.6 If either Party gives Notice of concealed or unknown conditions pursuant to GC 57.1, then as part of the Work the Contractor shall keep daily records in accordance with the requirements of GC 58 CLAIMS.

Part 12 PART 12 DISPUTE RESOLUTION

12.1 GC 58. CLAIMS

.1 If the Contractor intends to make a Claim for an extension of Contract Time or for an increase to the Contract Price, or if the Owner intends to make a Claim against the Contractor for a credit to the Contract Price, the Party that intends to make the Claim shall give timely Notice in writing of intent to Claim to the other Party and to the Engineer.

.2 Upon commencement of the event or series of events giving rise to a Claim, the Party intending to make the Claim shall:

(a) take all reasonable measures to mitigate any delay, loss or expense which may be incurred as a result of such event or series of events, and

(b) keep such records as may be necessary to support the Claim.

.3 The Party giving Notice of intent to make a Claim shall submit to the Engineer a detailed account of the amount claimed and the grounds upon which the Claim is based, within a reasonable time.

.4 Where the event or series of events giving rise to the Claim has a continuing effect, the detailed account submitted pursuant to GC 58.3 shall be considered to be an interim account and the Party making the Claim shall, at such intervals as the Engineer may reasonably require, submit further interim accounts giving the accumulated amount of the Claim and any further grounds upon which it is based. The Party making the Claim shall submit a final account after the end of the effects resulting from the event or series of events.

.5 The Engineer's findings, with respect to a Claim made by either Party, will be given by Notice in writing to both Parties within thirty (30) Business Days after receipt of the Claim by the Engineer, or within such other time period as may be agreed by the Parties.

.6 If such finding is not acceptable to either Party, the Claim shall be settled in accordance with this PART 12 DISPUTE RESOLUTION.

12.2 GC 59. APPLICABLE TO ALL DISPUTES

.1 In the event of a Dispute, the Contractor shall abide by the Engineer's decision with respect to the Dispute, proceed diligently with the Work without prejudice to the Contractor's right to advance any Claim it may wish to assert with respect to the Dispute and track all costs and impacts associated therewith.

.2 The Contractor shall not delay the Work or any portion of the Work, nor shall there be any extension of Contract Time solely on account of any Dispute Resolution pursuant to this PART 12 – DISPUTE RESOLUTION.

.3 Disputes between the Parties relating to or arising out of the Contract shall be settled in accordance with PART 12 DISPUTE RESOLUTION. No legal action shall be taken or

maintained without these provisions having been complied with, except to the extent that such legal action is necessary to:

(a) preserve a right or commence a Claim that would otherwise be barred by statute or another agreement if such legal action is not commenced or maintained; or

(b) obtain injunctive relief.

12.3 GC 60. NEGOTIATION

.1 A Party seeking resolution of a Dispute shall commence the negotiation process by serving a Notice requiring negotiation of the Dispute on the other Party and the Engineer. The date of delivery, or deemed date of delivery, as the case may be, is referred to in PART 12 DISPUTE RESOLUTION as the "Negotiation Notice Date". The Notice shall describe the Dispute and reference any time or money claimed and reference all of the provisions of the Contract that are relied on in relation to the Dispute.

.2 The Parties shall meet in person for the purpose of negotiating a resolution of the Dispute within fifteen (15) Business Days of the Negotiation Notice Date. Failure to meet within this time period means that, subject to the Parties otherwise agreeing, the negotiation will be deemed complete and either Party can immediately commence mediation in accordance with GC 61 MEDIATION.

.3 Each of the Parties shall discuss the Dispute in a professional and amicable manner and negotiate in good faith. The Parties agree to use all reasonable efforts to resolve any Dispute, whether arising during the existence of this Contract or at any time after the expiration or termination of this Contract, which touches upon the validity, construction, meaning, performance or effect of this Contract or the rights or liabilities of the Parties or any matter arising out of, or in connection with this Contract.

.4 Disputes that are resolved by negotiation shall be formally concluded with a binding agreement between the Owner and the Contractor, executed within thirty (30) Business Days of the Negotiation Notice Date, stating the details of the resolution. Disputes that are not fully concluded in this manner will proceed to mediation, or otherwise, pursuant to GC 60.6.

.5 All meetings and communications during the negotiation are without prejudice and cannot be used in evidence in any proceeding. The Parties shall treat the negotiation as confidential and neither of the Parties shall disclose any part of the negotiation to any third party, except for the sole purpose of dealing with the Dispute.

.6 In the event that the Parties cannot resolve the Dispute within thirty (30) Business Days of the Negotiation Notice Date, then, subject to the Parties otherwise agreeing, the Parties shall participate in mediation in accordance with GC 61 MEDIATION.

12.4 GC 61. MEDIATION

.1 If the negotiation process provided for in GC 60 NEGOTIATION is initiated but a Dispute is not resolved within thirty (30) Business Days from the Negotiation Notice Date or the negotiation is deemed complete pursuant to GC 60.2 NEGOTIATION either Party is entitled by Notice to the other Party to call for the appointment of an individual to act as a mediator. The date of delivery,

or deemed date of delivery, as the case may be, is referred to in GC 61 as the "Mediation Notice Date".

.2 Within fifteen (15) Business Days of the Mediation Notice Date, the Parties shall jointly nominate a mediator. The cost of the mediator shall be shared equally between the Parties. The mediator will be instructed to render invoices at monthly intervals. The Owner shall fully pay the mediator for services rendered upon presentation of an invoice by the mediator and deduct the Contractor's share from payments otherwise due to the Contractor. In the event that there are no payments due to the Contractor, the Owner shall invoice the Contractor for the Contractor's share of the cost of the mediator.

.3 The Parties shall submit their positions relating to the Dispute in writing to the mediator and afford to the mediator access to all Records, documents and information the mediator may reasonably request. The Parties shall meet with the mediator at such reasonable times as may be required and shall, as facilitated by the mediator, negotiate in good faith to resolve the Dispute. All meetings and communications with or involving the mediator are without prejudice and cannot be used in evidence in any proceeding. The Parties shall treat the mediation as confidential and neither of the Parties shall disclose any part of the mediation to any third party, except for the sole purpose of dealing with the Dispute.

.4 If the Dispute has not been resolved within forty (40) Business Days of the Mediation Notice Date then, subject to the Parties otherwise agreeing, the mediation shall be deemed to have been concluded.

.5 Once the mediation is concluded, or deemed to be concluded, any Dispute not settled may be litigated in accordance with the Law.

.6 If a mediator is not appointed within fifteen (15) Business Days of the Mediation Notice Date, the non-cooperating Party will be deemed to have agreed to arbitration by a sole arbitrator and the Party who gave the Notice to appoint a mediator may initiate arbitration proceedings pursuant to the ADR Institute of Canada Inc. ADRIC Arbitration Rules in effect at the date the arbitration proceedings are initiated. The arbitration shall be conducted in the jurisdiction of the Project Site.

Part 13 PART 13 INDEMNIFICATIONS AND WARRANTY

13.1 GC 62. INDEMNIFICATIONS

.1 The Contractor shall at all times and without limitation, be fully liable for, and shall indemnify and save harmless the Owner and its Personnel, including the Engineer, from and against all liabilities, losses, injuries, costs, damages, legal fees and disbursements on a solicitor and own client basis, disbursements, fines, penalties, expenses, all manner of actions, causes of action, claims, demands and proceedings, all of whatever nature and kind, which any of the Owner and its Personnel, including the Engineer, may sustain, pay or incur or which may be brought or made against all or any of them, and whether or not incurred, in connection with any action or other proceedings or claims or demands made by third parties, relating to, or resulting from or arising out of all or any of the following:

(a) the misconduct, negligent action or negligent failure to act, as the case may be, of the Contractor or any of those Persons for whom the Contractor is responsible at Law (including, without limitation, any of its Personnel or Subcontractors);

(b) the costs of repairs, clean-up or restoration paid by the Owner and any fines levied against the Owner or the Contractor;

(c) any breach, violation or non-performance of any representation, warranty, obligation, covenant, condition or agreement in this Contract set forth and contained on the part of the Contractor to be fulfilled, kept, observed or performed, as the case may be;

(d) any damages to third parties caused by, resulting at any time from, arising out of or in consequence of the misconduct, negligent action or failure to act of the Contractor or any of those Persons for whom the Contractor is responsible at Law (including, without limitation, any of its Personnel or Subcontractors);

(e) any damages, costs, fines, expenses and penalties that the Owner is required to pay on account of the Contractor performing the Work in breach of any Workers Compensation Legislation order or regulation; or

(f) any damages, costs, fines, expenses and penalties arising out of or as a result of the Contractor's failure, or the failure of any Person for whom the Contractor is responsible at Law, to comply with the requirements of GC 34 TOXIC OR HAZARDOUS SUBSTANCES.

.2 The provisions in GC 62 are in addition to and shall not prejudice any other rights of the Owner at Law or in equity.

.3 The Owner shall indemnify and hold harmless the Contractor and its Personnel from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the Contractor's performance of the Contract which are attributable to a lack of or defect in title to the Project Site.

.4 If the Owner performs work at the Project Site at the same time as the Contractor is performing the Work, then the Owner shall indemnify and hold harmless the Contractor and its Personnel from and against claims, demands, losses, costs, damages, actions, suits or proceedings by third parties that arise out of or are attributable to, any act or omission or alleged act or omission of the Owner and its Personnel in the performance of that work.

.5 If it becomes necessary for the Owner or its Personnel, including the Engineer, to take or to become involved in any action, including but not limited to legal proceedings, to enforce any term of this Contract, the Contractor shall be liable for and will pay to the Owner and its Personnel, including the Engineer, all costs, including but not limited to legal fees and disbursements on a solicitor and own client basis, incurred by the Owner and its Personnel, including the Engineer, in relation to the action to enforce any term of this Contract.

13.2 GC 63. WARRANTY

.1 The Contractor warrants that the Work, including all workmanship, labour, Materials and equipment supplied by the Contractor, either directly or indirectly, and incorporated into the Work, shall comply in all respects with this Contract and shall be free from Deficiencies.

.2 Subject to GC 63.3, the Warranty Period with regard to the Work shall be the longer of:

(a) one year from the date of Substantial Performance of the Work, for any Materials or portions of the Work which are supplied or completed before Substantial Performance of the Work is attained, unless a longer period is specified in the Contract Documents for such Materials or portions of the Work;

(b) one year from the date of Total Performance of the Work, for any Materials or portions of the Work which are supplied or completed after Substantial Performance of the Work is attained, unless a longer period is specified in the Contract Documents for such Materials or portions of the Work;

(c) one year from the date of Total Performance of the Work if some Work is excluded from the Substantial Performance of the Work assessment, where permitted by the Lien Act in effect at the Project Site, because a portion of the Work cannot be completed expeditiously for reasons beyond the control of the Contractor; and

(d) where a period longer than that described in GC 63.2(a) or GC 63.2(b) is specified in the Contract Documents, then that period specified in the Contract Documents shall apply from the date specified in the Contract Documents or, if no date is specified, from the date of Total Performance of the Work.

.3 Where Warranty Work is performed, regardless of the initial Warranty Period, the Warranty Period shall recommence for that Warranty Work for the same period as initially contemplated commencing on the date of completion of the Warranty Work.

.4 The Contractor shall promptly perform the Warranty Work, at the Contractor's expense, for all Deficiencies which appear prior to and during the Warranty Period for which the Contractor is provided Notice by the Owner or the Engineer no later than thirty (30) Business Days after the end of the Warranty Period.

.5 All Warranty Work carried out by the Contractor shall be performed during periods of time acceptable to the Owner.

.6 The Contractor shall ensure that any Warranty Work which is of an emergency nature, as reasonably determined by the Owner, is performed immediately upon receipt of Notice from the Owner or the Engineer.

Part 14 PART 14 CONFIDENTIALITY AND FREEDOM OF INFORMATION

14.1 GC 64. CONFIDENTIALITY

.1 The Contractor shall:

(a) hold, and shall take all reasonable steps to ensure that any Person employed, engaged or contracted by it holds all Confidential Information in strict confidence;

(b) not use, and shall take reasonable steps to ensure that any Person employed, engaged or contracted by it does not use any Confidential Information other than to perform the Work;

(c) not disclose, and shall take reasonable steps to ensure that any Person employed, engaged or contracted by it does not disclose, any Confidential Information to anyone other than those Persons engaged to perform the Work and then only to the extent that such Confidential Information is directly required to be disclosed in order to properly perform the Work; and

(d) not disclose, and shall take reasonable steps to ensure that any Person employed, engaged or contracted by it does not disclose any Confidential Information to any third party at any time during or subsequent to the duration of this Contract.

.2 The obligations set forth in GC 64.1 apply to any and all Confidential Information except that which:

(a) is required to be disclosed by applicable Law; or

(b) subject to the applicable Law, is in the public domain or is provided to its financial and legal advisors in confidence.

.3 The Contractor agrees that it shall not include any reference to the Owner, the Work or the Project in any advertisement, public announcement or statement, or promotional materials without the prior written consent being obtained from the Owner.

Part 15 PART 15 INTELLECTUAL PROPERTY AND TITLE TO THE WORK

15.1 GC 65. INTELLECTUAL PROPERTY

.1 The Contract Documents and models provided by the Engineer in any format are to be used only with respect to the Project and are not to be used for other work and are not to be copied or altered in any manner without the prior written authorization of the Engineer and the Owner.

.2 The Contractor shall indemnify and hold harmless the Owner, its Personnel, agents and consultants, including the Engineer, from any and all claims arising out of or as a result of an infringement or an alleged infringement of a copyright, or a trademark, patent or invention used or incorporated into the Work by the Contractor, the Subcontractors, or any Person for whom the Contractor is responsible for at Law.

.3 Subject to any limitations of liability expressly provided for in this Contract and any Law, the Owner shall, to the extent it can provide an indemnity in accordance with the Law, indemnify the Contractor against claims arising out of or as a result of an infringement or an alleged infringement of a patent relating to a model, plan, equipment or design which was provided to the Contractor by the Owner as part of the Contract Documents.

15.2 GC 66. BUILDERS LIENS AND TITLE TO THE WORK

.1 The Contractor shall remove or cause to be removed all affidavits of claim of lien, claims of lien or liens filed or registered against the lands and premises on which the Work is being performed

or has been performed which claim of lien or liens arise out of anything done or to be done under the Contract. Such removal shall be effected by the Contractor forthwith upon demand by the Owner or the Engineer. Upon receiving satisfactory security for its costs and a suitable indemnity, the Owner will authorize the Contractor to apply to the Court in the name of the Owner to have the affidavits of claim of lien, claims of lien or liens removed from the title to the lands upon payment into Court.

.2 Notwithstanding anything elsewhere contained in the Contract Documents, the Contractor shall indemnify and hold harmless the Owner against and from all demands, damages, costs, losses and actions arising in any way out of claims of lien or liens which arise out of anything done or to be done under the Contract.

.3 The obligations imposed on the Contractor by the provisions of GC 66 shall not extend to claims of lien or liens properly filed by the Contractor himself.

.4 The Contractor warrants that title to all of the Work and other matters or things produced for the benefit of the Owner shall be free of all claims.

.5 Title to all Materials shall, unless otherwise agreed in writing, vest in the Owner absolutely upon delivery to the Project Site or upon payment therefore, whichever shall first happen. All Materials shall remain at the risk of the Contractor until incorporated in the Work and Total Performance of the Work is achieved. Title to any Materials which are rejected by the Engineer or are ordered by him to be removed from the Project Site for any reason shall revest in the Contractor immediately upon receipt of Notice of rejection or order for removal.

.6 The Contractor warrants that Materials delivered to the Project Site shall:

(a) not be removed from the Project Site or changed except with the prior written authorization of the Owner; and

(b) at all times be kept secure.

15.3 GC 67. RECORDS

.1 The Contractor shall:

(a) maintain full Records of the estimated and actual costs of the Work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto. The Contractor shall maintain daily Records of the time, materials and equipment employed on the Work. Daily Records shall allocate the time, materials and equipment spent on each activity performed in a day to a description of that activity;

(b) preserve the Records for the Work during the term of the Contract and for a period of at least 3 years after Total Performance of the Work;

(c) make all Records and material referred to in GC 67.1(a) available to audit and inspection by the Owner and by Persons acting on behalf of the Owner when requested;

(d) allow any of the Persons referred to in GC 67.1(c) to make copies of and to take extracts from any of the Records and material referred to in GC 67.1(a); and

(e) provide any Person referred to in GC 67.1(c) with information that may be required from time to time in connection with such Records and material.

END OF DOCUMENT

MODIFICATIONS TO GENERAL CONDITIONS

The General Conditions are hereby revised as follows:

GC 37. PROGRESS PAYMENTS

Delete GC 37.9 in its entirety and replace with:

.9 Subject to GC 44 WITHHOLDING OF PAYMENT AND SET OFF, the Owner shall make payment to the Contractor of amounts due by the Owner no later than thirty (30) Business Days after the receipt by the Owner of the Payment Certificate as issued by the Engineer.

GC 47. DELAY

Delete GC 47.4 (c) in its entirety and replace with the following:

(c) be supported by a Contemporaneous Period Analysis; and

(d) be provided as a separate Notice.

GC 48. LATE COMPLETION

Add GC 48.4 as follows:

.4 The pre-estimate of the Owner's additional costs pursuant to GC 48.1 shall be $2000,00 per Working Day.

GC 56. FORCE ACCOUNT WORK

Delete GC 56.1 (b) its entirety and replace with the following:

(b) Equipment - The rates for equipment, vehicles, and power tools shall include operator's wages and fringe and other benefits, all maintenance and operating costs. Compensation will be paid at the rates listed in the latest edition of the Alberta Roadbuilders and Heavy Construction Association's Equipment Rental Rates Guidelines. The Contractor will be allowed a ten percent (10%) fee based on the gross cost of equipment as described above. Such fees shall be applied to the rental charge for equipment and will be the maximum paid regardless of the ownership.

GC 63. WARRANTY

All landscaping elements of the work shall have a two (2) year Warranty Period.

ADDITIONAL GENERAL CONDITIONS

GC68. EARLY USE OF THE WORK BY OWNER

.1 At the Owner's sole discretion and upon Notice to the Contractor, the Owner may take early possession of and use any completed or partially completed portions of the Work before Substantial Performance of the Work has been achieved. Such early possession and use by the Owner shall not constitute an acceptance of any portion of the Work which is not in accordance with the requirements of the Contract.

.2 If early use of particular completed or partially completed portions of the Work is expressly provided for in the Contract Documents then the Contractor will not be entitled to any adjustments of Contract Time or Contract Price as a result of such early use in accordance with those provisions.

.3 If early use of particular completed or partially completed portions of the Work is not expressly provided for in the Contract Documents, early possession or use of those portions of the Work shall be considered a Change and the provisions of GC 53 CHANGES shall apply.

.4 In the event that the Owner takes early possession of and uses any completed or partially completed portions of the Work before Substantial Performance of the Work has been achieved, then the Warranty Period for the portions of the Work that are under early possession or use by the Owner shall commence on the date the early possession and use commences.

.5 Despite the provisions of GC 69.3, under no circumstances shall possession and use of completed or partially completed portions of the Work be considered a Change if such possession and use commences after the expiry of the Contract Time. The Owner shall not be liable for any costs incurred by the Contractor after expiry of the Contract Time as a result of the Owner's possession and use of completed or partially completed portions of the Work.

GC69. OCCUPATIONAL HEALTH AND SAFETY

Contractor shall comply with the provisions of the Occupational Health and Safety Act, and amendments thereto and regulations thereunder or any successive legislation, and shall at all times ensure that all subcontractors at the Site shall comply with the requirements of the said Act and regulations thereunder. Contractor shall be the general representative and agent to Owner for the purposes of insuring compliance with safety regulations for both itself and subcontractors. Contractor shall bring to the attention of subcontractors the provisions of the Occupational Health and Safety Act and regulations thereunder.

For the purposes of the project, Contractor is assigned the role of Prime Contractor for the Site and is responsible for ensuring compliance with the Occupational Health and Safety Act by all employers and employees on the Site.

GC70. CANADIAN ANTI-SPAM LEGISLATION

.1 In accordance with Canadian anti-spam legislation, each Party consents to contacting the other Party and its personnel through electronic messages relating to the Project. Following completion of the Project, either Party may withdraw consent by contacting the other Party.

GC71. COVID-19 PANDEMIC

1. **COVID-19 PANDEMIC** – The Contractor and the Owner acknowledge the presence of the COVID-19 virus in Canada, and other jurisdictions forming part of the supply chain for materials and labour required for the Project (the "**COVID-19 Pandemic**").

2. **KNOWN IMPACTS** – The consequences and impacts of the COVID-19 Pandemic existing as of the date of this Agreement including, without restriction:

(a) orders, directives and recommendations of any Government Authority issued up to and including the date of this Agreement, and respecting public health or other requirements related to response to and prevention of infection by the COVID-19 virus;

(b) impacts to availability of labour or Materials required in order to carry out the Work, arising from the COVID-19 Pandemic;

(c) any the impacts of self-isolation/quarantine or regulated quarantine as regulated by the Province;

(the "**Known Impacts**"), are known to the Contractor and to the Owner, have been accounted for by the Contractor within the Construction Schedule, as well as the Contract Price.

3. Without restricting any of the foregoing, and notwithstanding anything contained within the Construction Contract, the Contractor and the Owner covenant and agree as follows:

(a) **Known Impacts –** the Contractor shall not be entitled to any Claims for changes to the Contract Schedule, or Claims for compensation, due to any Known Impacts;

(b) **No Reimbursement –** the Contractor shall not be entitled to any reimbursement of any costs, damages, losses and expenses incurred by the Contractor necessitated by a suspension or delay under GC 23 SUSPENSION OF WORK BY OWNER, where the suspension is due to a compliance with any order, directive or recommendation of any Government Authority related to the COVID-19 Pandemic, and/or due to any Known Impacts of the COVID-19 Pandemic;

(c) **No Suspension –** notwithstanding anything contained within GC 23 SUSPENSION OF WORK BY OWNER, a suspension of the Work because of a compliance with any order, directive or recommendation of any Government Authority related to the COVID-19 Pandemic, and/or because of any Known Impacts of the COVID-19 Pandemic, whether ordered by the Owner or the Engineer or not, shall not be deemed to be a suspension of the Work within the meaning of GC 23 SUSPENSION OF WORK BY OWNER;

(d) **Delay** – in the event that a "stop work" or similar order is issued by a court of Governmental Authority as a result of the COVID-19 Pandemic and provided that such order was not issued as the result of an act of fault of the Contractor or any Person for whom the Contractor is responsible at Law, the Owner may, acting reasonably but at its sole and absolute discretion, may extend the Contract Time by the number of Business Days from the date of an issuance of any stop work order to the issuance of a notice to proceed. , other than the foregoing and notwithstanding anything contained within GC 47 DELAY, no extension of the Contract Time shall be made and no adjustment in the Contract Price shall be made for any delay caused by a compliance with any order, directive or recommendation of any Government Authority related to the COVID-19 Pandemic, and/or caused by any Known Impacts of the COVID-19

Pandemic, whether ordered by the Owner or the Engineer or not, shall not be deemed to be a suspension of the Work within the meaning of GC 23 SUSPENSION OF WORK BY OWNER;

(e) **No Claims from Extensions Granted** – notwithstanding anything contained within GC 47 DELAY or GC 73.3(d) Delay, unless otherwise agreed to by the Owner, the granting of an extension of the Contract Time due to compliance with any order, directive or recommendation of any Government Authority related to the COVID-19 Pandemic, and/or due to any Known Impacts of the COVID-19 Pandemic, shall not give the Contractor grounds to make any Claims whatsoever for additional payment;

(f) **No Cumulative Effect –** notwithstanding anything contained within GC 47 DELAY, no extension of Contract Time shall be made and no adjustment in the Contract Price shall be made for any delay Claim that is based on the concept of the cumulative effect of orders, directives or recommendations of any Government Authority related to the COVID-19 Pandemic, and/or due to any Known Impacts of the COVID-19 Pandemic;

(g) **Self-Isolation/Quarantine** – the Contractor shall not be entitled to any Claims for changes to the Contract Time, or Claims for compensation, due to any requirement that an employee of the Contractor or any Subcontractor are required to self-isolate or quarantine as a result of diagnosis or potential diagnosis as being COVID-19 positive;

(h) **Contractor Termination** – the Contractor shall not be entitled to terminate this Agreement pursuant to GC 50 CONTRACTOR'S RIGHT TO TERMINATE FOR DEFAULT, and/or GC 23 SUSPENSION OF WORK BY OWNER, in the event that Work is stopped or delayed pursuant to GC 23 SUSPENSION OF WORK BY OWNER, where the suspension is due to an order, directive or recommendation of any Government Authority related to the COVID-19 Pandemic, and/or due to any Known Impacts of the COVID-19 Pandemic;

(i) **Claims** – any Claims for adjustment in the Contract Price that is based on the impact of orders, directives or recommendations of any Government Authority related to the COVID-19 Pandemic, and/or due to any Known Impacts of the COVID-19 Pandemic, shall be net of any and all compensation schemes, support programs, or other financial aids made available by any Government Authority, and any and all entitlements of the Contractor and any Subcontractor, together with their respective employees, under any such compensation schemes, support programs, or other financial aids; and

(j) **Mitigation** – notwithstanding anything contained within the Construction Contract, the Contractor's mitigation plan respecting the Known Impacts from the COVID-19 Pandemic will include the following:

(i) _____

(ii) _____

(iii) _____

GC 72 MATERIALS ON SITE

1. Further to GC 37.8:

2. The Owner may choose, at is sole discretion, to pay for materials delivered to site, prior to installation. Payment for materials on site will only be considered on the first two progress payments, with the cut-off for monthly invoices being the date agreed upon for progress payment during the pre-construction meeting. Materials on site will be subtracted from the monthly progress payments as products are installed and paid for under contract unit rates, the value subtracted will be an estimated percentage of the total amount of work completed.

3. Should the Owner choose to pay for these items, only the following items will be considered; manholes, main line pipe, service pipe, large diameter valves (150mm and larger), main line fittings (bends, elbows, tees, crosses reducers, adapters), and manhole lids, frames, covers and hydrants including shipping and freight costs for the specific items above.

4. No consideration will be made for small items; curb stops, main stops, service saddles, bolts, valve stems, curb stop keys, grease and o-rings, or any other item so designated at the Owner's sole discretion, regardless of the actual value of the products. Granular materials will not be considered. Contractor consumables, tools and internal handling costs will not be considered for payment.

5. Specialty products with long lead times may be considered at the discretion of the Owner.

6. Materials on site payment will not be considered for items that arrive to site and are installed within a single progress payment period, as these will be paid as part of the contract unit rates.

7. Items must be stored in a secure location, under the direct control of the Contractor; location may be on the project site within the contractor's laydown area within the Project Limits. The contractor assumes all responsibility for the security of the products and will at their expense replace any or all items that are damaged, stolen, or otherwise made unusable for the purposes of the Work prior to installation. The owner or the owner's representative will be provided access to the storage location in order to verify items on the invoices.

GC 73 SUBSTANTIAL COMPLETION AND TOTAL COMPLETION

Further to GC 40 and 42:

1. A Substantial Completion Certificate will not be issued until a Construction Completion Certificate (CCC) has been issued by the City of Whitehorse, in accordance with the City of Whitehorse Servicing Standards Manual, Part I – Procedures, Section 1.4.

2. A Total Completion Certificate will not be issued until a Final Acceptance Certificate (FAC) has been issued by the City of Whitehorse, in accordance with the City of Whitehorse Servicing Standards Manual, Part I – Procedures, Section 1.5.

END OF DOCUMENT

Without limiting any of Contractor's obligations or liabilities under the Contract Documents, Contractor shall, and shall cause its Subcontractors to, obtain and continuously carry, while Work is being performed and, unless otherwise specified in this Section, while any remedial or warranty work is being undertaken, at Contractor's own expense and cost, the following insurance coverage with minimum limits not less than those stated:

Commercial General Liability Insurance

Commercial General Liability Insurance, in a form acceptable to Owner, with limits of not less than $5,000,000.00 inclusive per occurrence for bodily injury, death and damage to property, including loss of use thereof.

Commercial General Liability policy shall include the following:

a. Additional Insured: Owner and Engineer are added as additional insured, but only with respect to liability arising out of the Contractor's performance of the Contract.
b. Bodily Injury and Property Damage to third parties arising out of the operations of the Contractor.
c. Products and Completed Operations: Coverage for bodily injury or property damage arising out of goods or products manufactured, sold, handled, or distributed by the Contractor and/or arising out of operations that have been completed by the Contractor.
d. Personal Injury: While not limited to, the coverage must include Violation of Privacy, Libel and Slander, False Arrest, Detention or Imprisonment and Defamation of Character.
e. Cross Liability/Separation of Insureds: Without increasing the limit of liability, the policy must protect all insured parties to the full extent of coverage provided. Further, the policy must apply to each Insured in the same manner and to the same extent as if a separate policy had been issued to each.
f. Blanket Contractual Liability: The policy must, on a blanket basis or by specific reference to the Contract, extend to assumed liabilities with respect to contractual provisions.
g. Employees must be included as Additional Insured.
h. Employers' Liability (or confirmation that all employees are covered by Worker's compensation (WSIB) or similar program)
i. Broad Form Property Damage including Completed Operations: Expands the Property Damage coverage to include certain losses that would otherwise be excluded by the standard care, custody or control exclusion found in a standard policy.
j. Notice of Cancellation: The Insurer will provide the Owner thirty (30) days written notice of policy cancellation.
k. Owners' or Contractors' Protective Liability: Covers the damages that the Contractor becomes legally obligated to pay arising out of the operations of a subcontractor.
l. Non-Owned Automobile Liability - Coverage for suits against the Contractor resulting from the use of hired or non-owned vehicles.
m. All Risks Tenants Legal Liability - to protect the Contractor for liabilities arising out of its occupancy of leased premises.
n. Sudden and Accidental Pollution Liability (minimum 120 hours): To protect the Contractor for liabilities arising from damages caused by accidental pollution incidents.

Automobile Insurance (Owned and Non-Owned)

Automobile Liability Insurance in an amount usual for a contract of this nature, but for not less than $2,000,000 per accident or occurrence., covering death and damage to property, effective for all licensed vehicles owned, leased, rented or used by Contractor.

The policy shall include the following:

a. Third Party Liability - $2,000,000 Minimum Limit per Accident or Occurrence
b. Accident Benefits - all jurisdictional statutes
c. Uninsured Motorist Protection
d. Notice of Cancellation: The Insurer will endeavour to provide the Contracting Authority thirty (30) days written notice of cancellation

Contractors' Equipment Insurance

"All-Risk" Contractors' Equipment Insurance to the full insurable value of construction machinery and equipment used by Contractor in the performance of Work, including boiler insurance for temporary boilers and pressure vessels as applicable.

Builders Risk Insurance

"All-Risks" Course of Construction Insurance in the joint names of Contractor, Owner and Engineer, with the subcontractors as unnamed insureds, insuring not less than one hundred and ten percent (110%) of the sum of the amount of the Contract Price and the full value of materials provided by the Owner for incorporation into Work, with a deductible not exceeding $5000.00. Such coverage to contain sublimits for materials in transit and materials stored at unnamed locations. Builders Risk Insurance shall be obtained and carried until Total Performance of the Work.

Unmanned Aerial Vehicle Liability Insurance

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

All policies of insurance shall be in a form acceptable to Owner and shall not allow subrogation claims by the insurer against Owner or Engineer.

All policies of insurance that Contractor is required to obtain will be considered as primary insurances in relation to insurances held by Owner or Engineer without any right of contribution from any policies of insurance held by Owner or Engineer.

All policies of insurance shall provide that at least thirty 30 days prior written notice be given to Owner in the event of cancellation or amendment restricting coverage.

Prior to commencing Work, Contractor shall provide Owner with Certificates of Insurance in a form acceptable to Owner, and with a letter from the insurer stating that the insurance provided complies with the requirements of the Contract.

Deductibles, if any, which are applicable to the insurance specified herein, shall be borne by Contractor.

The specified limits of insurance and coverages in no way define or limit the obligation of Contractor to indemnify Owner in the event of loss.

Owner makes no representation or warranty with respect to the extent or adequacy of the insurance protection afforded by the insurance policies that are specified in this section. Contractor shall be fully responsible to determine additional insurance coverages that may be necessary and advisable for protection of Contractor or to fulfil Contractor's obligations under this Contract.

END OF DOCUMENT

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises generally of the supply and installation of water mains, sewer mains, and storm sewers, general excavation and lot grading, supply and installation of granular materials, installation of shallow utilities, concrete and asphalt surface works, and related works.

1.2 WORK BY OTHERS

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

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

.3 Work done by others includes:

- .1 Work and inspections by NorthwesTel, ATCO Yukon Electric and City of Whitehorse on an as required basis.
- .2 Work on Phase 1 of the C-9B Subdivision.
- .3 Work of housing Contractors.
- .4 Work in other Phases (Phases 6, 7, & 8, 9a, 9b, 10, 12, Midnight Sun Lift Station) of the Whistle Bend Subdivision.
- .5 Work by other Contractors.

1.3 CONTRACTOR USE OF SITE

.1 Unrestricted use of site until Substantial Performance or as otherwise outlined.

.2 Limit use of site for Work, for access, to allow:

- .1 Owner occupancy as required.
- .2 City of Whitehorse occupancy and inspections.
- .3 Work and inspections by NorthwesTel, ATCO Yukon Electric.
- .4 Work by other contractors.
- .5 Public usage.

.3 Co-ordinate use of premises under direction of Consultant.

.4 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.4 OWNER OCCUPANCY

.1 Owner and City of Whitehorse will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with Owner, City of Whitehorse, NorthwesTel, ATCO Yukon Electric and other Contractors in scheduling operations to minimize conflict and to facilitate usage.

1.5 OWNER FURNISHED ITEMS

.1 Schedule of Owner furnished items:

.1 Electronic copy of the drawings for layout purposes.

.1 Electronic files provided by the Owner are "as is" and at the Contractor's request, without warranty of any kind, whether express or implied. All implied warranties, including, without limitation, implied warranties of accuracy, completeness, merchantability, fitness for a particular purpose, and non-infringement, are hereby expressly disclaimed.

.2 Under no circumstances will the Owner or the Consultant be liable to any Person for any direct, indirect, special, incidental, or other damages including Consequential Damages and, without limitation, any loss of programs or information, based on any use of this information or any information referenced therein, even if the Owner or the Engineer has been specifically advised of the possibility of such damages.

.2 All other materials required of the Work shall be supplied but the Contractor.

1.6 PROJECT SPECIFIC MATERIALS & INFORMATION

.1 The Contractor shall note that all Technical Specifications have been updated.

.2 Water and Sewer Mains and Fittings

.1 Water mains for the project shall be PVC or Ductile Iron in accordance with the Technical Specifications.

.2 Sewer mains for the project shall be PVC in accordance with the Technical Specifications.

.3 Fitting shall be Ductile Iron with Tyton Joints.

.4 Pipe and Fitting restrainers shall be Uni-Flange.

.3 Water Services

.1 Water and recirculation service materials.

.1 Insulated HDPE DR 11 joined by the method of thermal butt-fusion. Compression couplings are only acceptable at the main stop and curb stop.

.2 Water service piping shall be one continuous length of pipe when the distance between the mainline and curb stop is less than one standard pipe length, with no joints between the main stop and the curb stop.

.3 Where the mainline and curb stop are further apart then one standard pipe length, joints may only be used between standard pipe lengths.

.4 No joints may be made between the curb stop and the termination of the pipe in new construction where the service is left for a future owner. In Reconstruction projects unless the distance from the curb stop to the

existing building is greater than 1 standard pipe length no joints will be permitted.

.2 Main/Curb Stops

.1 In addition to Section 8.2.1 Ford Meter Box is an acceptable supplier.

.1 Ball valve Surb Stop with Stop and Waste

.1 BC44-xxxSW-Q-NL

.2 Ballcorp Corporation Stops

.1 FB1000-xx-Q-NL

.3 Grease for water services shall be NSF 61 Certified.

.1 Acceptable products:

.1 FUCHS CHEMPLEX 862.

.2 CLEARCO SILICONE GREASE 2012 NSF 61.

.4 Adjustment of Appurtenances

.1 Adjustment of existing and proposed appurtenances are considered incidental to the Work. No additional payment shall be made for adjustment of appurtenances.

.5 Valve Boots

.1 Valve boots are required on all mainline valves large than 200mm, valve boot shall cover the entire top of the valve to prevent the ingress of rocks or debris between the valve nut and the valve stem. Valve boots will be considered incidental to the supply and install cost of the valves.

.6 Traffic Control

.1 The Contractor shall be responsible for all Traffic Control during the Work.

.2 The Contractor shall provide a Traffic Control Plan 15 days prior to the Pre-Construction Meeting and update as requested by the Consultant.

.1 Level I Traffic Control shall be required throughout the Work.

.2 Level II Traffic Control Shall be required where the width of the road is insufficient to maintain two-way traffic flow.

.3 The Contractor shall only access the Project Area off the north of end of Marathon Way intersecting with Witch Hazel Drive. Contractor will be responsible for sweeping, maintenance and repair of Marathon Way and Witch Hazel at the intersection as directed by the Engineer.

.4 The Contractor shall be responsible for the maintenance and dust control at the access to site regardless of use by other Contractors or City of Whitehorse.

.7 Boulevard Infill

.1 The contractor shall backfill boulevards, between curb and sidewalk, and medians to top of curb. The material must be approved by the Engineer, and placed in lifts of 150mm, compacted to a minimum of 95% Standard Proctor Density. Boulevard infill shall be considered incidental to the Work.

.8 Street Identification Signage

.1 Supply and installation of street identification and regulatory signage shall be included within the Contract. The Contractor shall submit shop drawings for review by the Engineer, City of Whitehorse and Ta'an Kwäch'än Council prior to ordering to confirm street naming a minimum of 4 weeks prior ordering. Street identification and regulatory signage shall be erected prior to Substantial Completion (GC 14.0).

.9 Pipe Bedding Materials

.1 The Contractor shall supply and install Bedding Stone for all water mains and sanitary mains both above and below the pipe as per Contract Drawings. Storm mains shall be either Bedding Sand or Bedding Stone as per Section 7 - Sewer Mains

.2 Sand Bedding shall be used on all water and sanitary services unless in wet trenching conditions.

.10 Asphalt Joints

.1 Contractor shall saw cut and tack all joints that are not attached on the same paving day or which have become cold in the option of the Engineer. Payment for this shall be included in the applicable unit item and no additional payment will be made elsewhere.

.11 Para ramp Locations

.1 All para ramp locations and alignments shall be confirmed onsite with the Engineer and City of Whitehorse prior to placement. Provide the Engineer and City of Whitehorse 5 days written notice prior to review.

.12 Storm Sewers and Manholes

.1 In addition to Section 7.2.3, the following products are acceptable as approved alternatives.

.1 Canada Culvert Flocor aluminized, 2.0 mm thickness.

.1 Couplers shall be annular type, 2.0 mm thickness, with neoprene gaskets.

.2 Atlantic Industries Limited Hi-Flo aluminized, 2.0 mm thickness.

.1 Couplers shall be annular type, 2.0 mm thickness, with neoprene gaskets.

.3 ADS N-12 WT IB Pipe (CSA C182.8)

.2 All manhole and catch basin manhole access locations shall be confirmed onsite with the Engineer and City of Whitehorse prior to finalization. Rotate as required based on Engineer and City of Whitehorse requirements.

.13 Groundwater & Wet Soil Conditions

.1 Groundwater flows and wet soils conditions have been encountered in trenches and excavations during previous Whistle Bend phases of construction. It is expected that groundwater and wet soil conditions will be encountered during C-9B construction. Contractors should be prepared to dewater as required to complete the work, and allow for working soils with high moisture content, prior

to reuse, to reduce moisture content to achieve required compaction. These costs and related impacts should be included in the applicable unit rates.

.14 Catch Basin Leads

.1 In addition to section 7.2.5 of Section 7 – Sewer Main, Ductile Iron pipe in accordance with 7.2.1 may be used as catch basin leads.

.15 Sewer Main Connections

.1 In addition to Section 9.3.2 sewer services connection to mains may utilize Galaxy Plastics EZ-Tee.

.2 Contractors are cautioned that the gasket lip installation can be problematic and result in future excavation for confirmation of install or repairs by the Contractor. Contractor shall take appropriate actions

.16 Stockpiling

.1 Stockpile in locations as indicated or directed by the Engineer.

.2 Maintain minimum 3 m separation from vegetation or treeline.

.3 Permanent stockpiles shall have slopes no greater than 1.5h:1v.

.4 Maintain stockpile as directed by Engineer.

1.7 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed Shop Drawings.

.5 List of Outstanding Shop Drawings.

.6 Change Orders.

.7 Other Modifications to Contract.

.8 Field Test Reports.

.9 Copy of Approved Work Schedule.

.10 Health and Safety Plan and Other Safety Related Documents.

.11 Other documents as specified.

1.8 STANDARD DETAILS

.1 Standard details have been incorporated into the drawing set, these details are generalized versions of materials and products to be installed and may not represent all aspects of specific products used by the Contractor. All products will be installed in accordance with their specific manufacture's installation procedures and best practices. Any deviation from minimum and maximum measurements on details will require written approval from both the manufacturer and Engineer prior to acceptance and payment. Details are not to scale and dimensions should not be scaled from the unless otherwise noted. Notes within details supersede all drawn representations of the product and installation.

END OF SECTION

Part 1 General

1.1 EASEMENTS & RIGHTS-OF-WAY

.1 The Contractor shall confine his work, workers, materials and equipment to the road allowances, rights-of-way or easements made available by the Owner for carrying out this work. Where private property must be crossed the Owner is responsible for arranging suitable easements and right of entry to permit construction to proceed. The Contractor shall ensure that all machinery, excavated materials, materials to be incorporated in the work, and employee access, be maintained within the prescribed limits.

.2 If the Contractor feels that additional property is required to facilitate his operations under the contract, he shall first obtain the appropriate written permission of the property owner with notice to the Consultant prior to entering the property. No claim shall be made by the Contractor due to such permission not being granted.

1.2 NIGHT WORK

.1 Construction work between 11 P.M. and 7 A.M. will only be allowed if acceptable to the local authority having jurisdiction and notification of and consent to such work is given beforehand by the Consultant. When work is carried out after dusk and before dawn the Contractor shall supply at his own cost enough electric or other approved lights to enable the work to be done in an efficient and satisfactory manner and in accordance with applicable OH&S Regulations. No work shall be done if there is insufficient light to perform the work safely and satisfactorily.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted.

1.4 WORK BY OTHERS

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

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

.3 Work done by others includes:

- .1 Work in Phase 1 of the C-9 Subdivision.
- .2 Work undertaken by housing contractors.
- .3 Work and inspections by NorthwesTel, ATCO Yukon Electric and City of Whitehorse on an as required basis.
- .4 Work in other Phases of the Whistle Bend Subdivision.

END OF SECTION

Part 1 General

1.1 SELECTION OF ALTERNATIVES

.1 Whenever any material or equipment is specified by patent or proprietary name or by the name of the manufacturer, such specification shall be considered as used for the purpose of describing the material or equipment desired and shall be considered as if followed by the words "or approved equal", whether or not such words appear. The Contractor may offer material or equipment with equal or better qualities and performance in substitution for those specified which he considers will be in the Owner's interest to accept. Any such offer shall be made in writing to the Consultant for his consideration at least four (4) weeks in advance of the time at which the Contractor wishes to order the said material or equipment for use in the work, and the Contractor shall include with his offer sufficient data which, together with any other data the Consultant may request, will enable the Consultant to assess the acceptability of the said material or equipment. When the substitute material or equipment necessitates changes to or co-ordination with any other portion of the work, the data submitted shall include drawings and details showing all such changes, and the Contractor shall perform these changes as part of any acceptance of substitute material or equipment. The use of any material or equipment so offered will be permitted only after written notification that the Consultant is satisfied that such substituted material or equipment is compliant with the contract documents. Such notification shall not relieve the Contractor from full responsibility for the efficiency, sufficiency and quality, and performance of the substitute material or equipment in the same manner and degree as the material and/or equipment specified by name.

END OF SECTION

GENERAL

1. Payment will be made on the basis of the lump sum and unit prices contained in the Price Form, and in accordance with the General Conditions.

2. The contract unit price for supplying and installing of materials shall be full compensation for supplying, hauling, delivering, loading and unloading, storage, handling, installing, cleaning, testing, and placing in service, together with all other work subsidiary and incidental thereto for which separate payment is not provided elsewhere.

3. Ownership of materials rests with the Owner except where specifically identified as owned by the Contractor.

4. All measurement for payment shall be taken by the Engineer and such measurement for payment will only be taken when the Engineer determines satisfactory completion of all items described within the Measurement and Payment clause.

5. Where "Price only" unit prices are identified, the unit prices are intended as information related to possible extra works and are to be paid out of Contingency Allowance if required. They are not to be extended to the Extended Total Price Column.

A. SITEWORKS

1.0 MOBILIZATION / DEMOBILIZATION

Mobilization shall include the Contractor's costs of mobilization; bonding; insurance; permits; moving personnel, equipment, and materials to the site; setting up temporary facilities; coordination with other Contractors; storage of materials; all preparation for performing the work; and full demobilization of the above. Demobilization shall also include site clean-up and costs associated with the warranty period. Mobilization and demobilization will only be paid for once even regardless of the number of times the contractor mobilizes or demobilizes.

The Engineer using discretion may recommend partial payment if mobilization or demobilization is not complete.

Payment: Tendered **Lump Sum** price bid. (Total cost shall not exceed 10% of the total contract value)

Measurement: 60% of the lump sum tendered will be included in the first progress payment certificate,
40% of the lump sum tendered will be included in the final progress payment certificate.

2.0 ENVIRONMENTAL COMPLIANCE

Payment for Environmental Compliance is to be full compensation for the following:

.1 Preparation of the Environmental Protection Plan (EPP).
.2 Compliance with the EPP including the design, construction and maintenance of environmental protection activities, including but not limited to, sediment and erosion control; oil and fuel storage and spill plans; contaminated soil testing, storage, removal or treatment procedures; water and wastewater use; equipment servicing and washing areas; water truck loading areas and pumping operations; procedures to test for and take leaking equipment out of service; garbage disposal and litter control; and protection of natural resources and wildlife.
.3 Attendance at environmental briefings, meetings and inspections by the appropriate employees of the Contractor as necessary.
.4 Hiring of Environmental Monitor for the Work and development of associated Workplans and remedial actions.

Payment: Tendered **Lump Sum** price bid.

Measurement: Lump sum payable based on the percentage of work complete.

3.0 TRAFFIC CONTROL

Payment for this item shall include the supply and erection of all necessary signs, sign inspection, maintenance and dust control, sweeping, access road maintenance, preparation and submission of daily sign log sheets, flag persons and detours required or as specified by the Engineer to provide safe, efficient traffic control during the construction period in accordance with the specifications, YG Occupational Health and Safety Handbook, the Transportation Association of Canada Uniform Traffic Control Devices Standard, and any incidental work for which payment is not specified elsewhere.

Payment: Tendered **Lump Sum** price bid.

Measurement: Lump sum payable based on the percentage of work complete.

The Engineer may recommend partial, or if necessary, negative payment if traffic control and or maintenance is not completed satisfactorily, or if the Contractor fails to conform to the specifications. This item is subject to a payment reduction equalling an Owner fine of $5,000.00 per violation.

4.0 CONSTRUCTION SURVEYING

Payment for this item shall be compensation in full for supplying all supplies, stakes, flagging, nails, materials, and personnel required to provide construction surveying and record survey, reporting and delivery of specified information services. Construction survey services are comprised of all measurements from Engineer supplied control points to ensure the correct installation of all Work. Redline drawing markups shall be submitted monthly in order to process the progress payment.

Payment: Tendered **Lump Sum** price bid.

Measurement: The successful completion of all surveying required to install the work, maintain survey records and drawing redlines, to be paid as a percentage as the work progresses.

5.0 UTILITY COORDINATION

The Contractor shall undertake coordination with all utility providers (Atco Yukon Electric Ltd., Yukon Energy Corporation, Northwestel) with infrastructure within the project boundaries. Payment for this item shall be compensation in full for communications and coordination with the utility providers, costs for locating all existing utilities (live or empty conduits), costs incurred for crossing or working adjacent to overhead lines, costs for temporary infrastructure support and cost for utility supervision. Communication with the utilities shall be in the form of meetings and writing to advise in advance of works imminently affecting residents or businesses. Written communications shall be on official Contractor's Company letterhead, and shall include Company and Superintendent contact details. The Lump Sum shall be paid in relation to the percentage of Contract Works completed to date, in the opinion of the Engineer.

Payment: Tendered **Lump Sum** price bid.

Measurement: Lump Sum payable on the percentage of work completed.

6.0 UTILIZATION OF CITY FORCES

The Contractor may be required to utilize City of Whitehorse forces within the course of construction. Payment for this item shall be compensation in full for such requirements as, but are not limited to valve operation, tie-in scheduling and inspection and general coordination. The Contractor shall utilize City forces when required within a Contract through a City of Whitehorse Work Order completed prior to the required work. The Lump Sum shall be paid in relation to the percentage of Works completed to date, in the opinion of the Engineer.

Payment: Tendered **Lump Sum** price bid.

Measurement: Lump Sum payable on the percentage of work completed.

7.0 CLEARING, SALVAGE AND DECKING (PROVISIONAL)

Payment for this item shall be compensation in full for hand and or machine cutting, harvesting, de-limbing, transporting and stockpiling of salvageable fuel wood onsite in approved area, cutting, chipping, loading, hauling and disposal of non-salvageable materials to the City of Whitehorse landfill or an approved offsite disposal site, and any incidental work for which payment is not specified elsewhere. No additional payment is made for tipping fees or permits.

Payment: Tendered unit price bid per **hectare** cleared.

Measurement: Field measured and area calculated.

8.0 GRUBBING, STRIPPING AND DISPOSAL (PROVISIONAL)

Payment for this item shall be compensation in full for excavation, loading, hauling and disposal, to the specified approved disposal site all clearing debris, roots, stumps, submerged logs, corduroy, trees, limbs, brush, boulders, other non-salvageable materials, suitable stripping materials down to mineral soil at whatever depth and condition it may occur, and any incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **hectare** grubbed and stripped.

Measurement: Field measured and area calculated.

9.0 LAYDOWN AREA (PROVISIONAL)

Payment for this item shall be compensation for construction and removal of a contractor designated laydown areas as indicated on the drawings. The laydown area shall include perimeter chain link fencing, two locking vehicle access gates and suitable granular materials as determined by the contractor to make the area suitable for contractor use for the duration of the project. Upon completion of the project, all fencing, contractor equipment and supplies shall be removed and the laydown area shall be cleaned for use in future phases.

Payment: Tendered **Lump Sum** price bid.

Measurement: 60% of the lump sum tendered will be included in the first progress payment certificate,
40% of the lump sum tendered will be included in the final progress payment certificate.

B. WATERWORKS

1.0 TRENCHING AND NATIVE BACKFILL (All Depths and Widths)

Payment for this item shall be compensation in full for trenching to the specified depth, including the pipe zone, and width, shoring, dewatering, trench maintenance, backfilling, moisture conditioning, compacting to the specified density, grading, cleanup, culling and disposal of oversize and or excess materials, and any other incidental work for which payment is not specified elsewhere. This item will only be paid once, even if more than one pipe is placed in a common trench. Payment for this item shall be made in addition to payment for supplying and installing of water main.

Payment: Tendered unit price bid per **lineal metre** for all the depth ranges and number of pipes installed. Payment will be limited to 75% of total lineal meters installed until satisfactory Water System Pressure, Leakage and Expansion Testing has successfully passed and system will remain active.

Measurement: Length shall be measured in **metres** along the centreline of the pipe

2.0 SUPPLY AND INSTALL WATERMAIN (P.C. 350 D.I. or PVC C900)

Payment for this item shall be compensation in full for supplying, loading, hauling, unloading, stinging the pipe, laying and jointing to the specified line and grade of water main of the type, class and diameter specified, supplying and placing of the specified bedding and pipe zone material, compacting the bedding and pipe zone material to the specified density, and any other incidental work for which separate payment is not specified elsewhere. Installation of trench plugs will be considered incidental to this work. The price paid shall not include trenching and backfilling.

Payment: Tendered unit price bid per **lineal metre** for each pipe type, class, diameter and bedding class installed. Payment will be limited to 75% of total lineal meters installed until satisfactory Water System Pressure, Leakage and Expansion Testing has successfully passed and system will remain active.

Measurement: Field measured in **metres** along the centreline of the pipe with no deductions for valves or fittings from centre to centre of pipe fittings or pipe ends.

3.0 SUPPLY AND INSTALL WATERMAIN FITTINGS

Payment for this item shall be compensation in full for the supplying, loading, hauling, unloading and installation of fittings of the type, class and diameter as specified, including jointing, temporary supports, reaction or anchor blocks, joint restraint, and any other incidental work for which separate payment is not specified elsewhere. The price paid shall not include trenching and backfilling.

Payment: Tendered unit price bid for **each** fitting type, class and diameter installed as detailed.

Measurement: Each.

4.0 SUPPLY AND INSTALL HYDRANT ASSEMBLY

Payment for this item shall be compensation in full for the supplying, loading, hauling, unloading and installation of a flanged hydrant tee of the sized specified, in-line hydrant, reaction blocking, bracing, supplying and installing a rock sump where necessary, and any other incidental work for which separate payment is not specified elsewhere. The price paid shall not include trenching and backfilling.

Payment: Tendered unit price bid per **each** hydrant assembly installed as detailed.

Measurement: Each.

5.0 SUPPLY AND INSTALL WATER MAIN VALVE

Payment for this item shall be compensation in full for the supplying, loading, hauling unloading and installation of the valve of the type and diameter specified, including jointing, complete with valve box, extension stem, rock guard or valve boot and all necessary bracing, supplying and application of field insulation kits or half shells and heat shrink sleeves where indicated, the supplying and installing any appurtenance including reaction or anchor blocks, and any other incidental work for which payment is not specified elsewhere. The price paid shall not include trenching and backfilling.

Payment: Tendered unit price bid for **each** valve type and diameter installed as detailed.

Measurement: Each.

6.0 RELOCATE EXISTING GATE VALVE (ALL SIZES)

Payment for this item shall be compensation in full for excavating to the required depth and width beyond the standard trench, disposal to an approved site of any oversize or excess excavated material, shoring, de-watering, trench maintenance, locating, cutting, removal, salvage and/or disposal to an approved site of existing piping and/or fittings, relocating existing gate valve as directed by engineer, connection to the existing main with fittings as required, reaction and/or anchor blocks, flushing and cleaning existing main after connection, supplying, placing approved backfill, compacting to the specified density, and any other incidental work.

Payment: Tendered unit price bid per **each** valve relocated.

Measurement: Each.

7.0 TIE TO EXISTING WATER MAIN

Payment for this item shall be compensation in full for excavating to the required depth and width beyond the standard trench, disposal to an approved site of any oversize or excess excavated material, shoring, de-watering, trench maintenance, locating, cutting, removal, salvage and disposal to an approved site of existing piping and/or fittings, connection to the existing main with fittings as required, reaction or anchor blocks, flushing and cleaning existing main after connection, supplying, placing approved backfill, compacting to the specified density, and any other incidental work.

Payment: Tendered unit price bid per **each** connection to existing pipe.

Measurement: Each.

8.0 WATER SYSTEM PRESSURE, LEAKAGE AND EXPANSION TESTING

Payment for this item shall be compensation in full for the preparation of plan, supplying of equipment, labour and materials to conduct pressure, leakage and expansion testing including supplying and installing of appropriately sized temporary service connections, plugs and reaction blocking where necessary, removal of piping and reaction blocking, and closure of main stop after testing is complete, and any other incidental work for which separate payment is not specified elsewhere. The Engineer shall witness the test done by the contractor and produce a pressure, leakage and expansion testing report.

Payment: Tendered **Lump Sum** price bid for the pressure, leakage and expansion testing. Multiple payments will not be made for multiple testing processes regardless of total number completed.

Measurement: Lump sum payable upon successful completion of pressure, leakage and expansion testing of the entire system at Substantial Completion.

9.0 WATER SYSTEM DISINFECTION, FLUSHING AND COMMISSIONING

Payment for this item shall be compensation in full for the preparation of plan, supplying of equipment, labour and materials to undertake disinfection, de-chlorination and water disposal where specified by the Engineer, flushing the main safely and commissioning the completed water system.

Payment: Tendered **Lump Sum** price bid for the disinfection, de-chlorination, water disposal, flushing and commissioning of the entire water system within the project area. Multiple payments will not be made for multiple disinfection, flushing and commissioning processes regardless of total number completed.

Measurement: Lump sum payable upon successful completion of disinfection, de-chlorination, water disposal, flushing and commissioning of the entire system at Substantial Completion.

C. SANITARY SEWERS

1.0 TRENCHING AND NATIVE BACKFILL – (All Depths and Widths)

Payment for this item shall be compensation in full for trenching to the specified depth, including the pipe zone, and width, shoring, de-watering, trench maintenance, backfilling, moisture conditioning, compacting to the specified density, grading, clean-up, culling and disposal of oversize and or excess materials, and any other incidental work for which payment is not specified elsewhere. This item will only be paid once, even if more than one pipe is placed in a common trench. Payment for this item shall be made in addition to payment for supplying and installing of storm sewer main.

Payment: Tendered unit price bid per **lineal metre** for the various depth ranges and number of pipes installed. Payment will be limited to 75% of total lineal meters installed until satisfactory T.V. Inspection and Reporting is completed and reviewed by the Engineer.

Measurement: Length shall be measured in metres along the centreline of the pipe.

2.0 SUPPLY AND INSTALL SEWER MAIN (PVC SDR 35)

Payment for this item shall be compensation in full for supplying, loading, hauling, unloading, stringing the pipe, laying and jointing to the specified line and grade of sewer main of the type, class and diameter specified, connection to manholes or catch basin manholes, supplying and placing of the specified bedding and pipe zone material, compacting the bedding and pipe zone material to the specified density, flushing and cleaning the pipe, and any other incidental work for which separate payment is not specified elsewhere. The price shall also include the additional costs for supplying, handling and installing insulated pipe where specified. Installation of trench plugs will be considered incidental to this work. The price paid shall not include trenching and backfilling.

Payment: Tendered unit price bid per **lineal metre** for each pipe type, class, diameter and bedding class installed. Payment will be limited to 75% of total lineal meters installed until satisfactory T.V. Inspection and Reporting is completed and reviewed by the Engineer.

Measurement: Field measured in metres along the centreline of the pipe with no deductions for manholes from centre of manhole to centre of manhole or from the centre of a manhole to a required termination where applicable.

3.0 SUPPLY AND INSTALL MANHOLE BARRELS

Payment for this item shall be compensation in full for excavating the trench wall to the depth and width specified beyond the standard trench, supplying and installing of all barrels, O rings, safety platforms, insulation, breaking into the manhole, connection of sewer pipe to the manhole, mortaring of joints flush to the wall and waterproofing as required, backfilling with approved material and compacting to the specified density beyond the standard trench, and any other incidental work for which payment is not specified elsewhere. Installation of trench plugs will be considered incidental to this work. No additional payment will be made for the sump of a catch basin manhole.

Payment: Tendered unit price bid per **vertical metre** installed.

Measurement: Field measured from the top of frame to the invert of the lowest pipe.

4.0 SUPPLY AND INSTALL MANHOLE FRAME, COVER AND BASE

Payment for this item shall be compensation in full for excavating the trench wall to the depth and width specified beyond the standard trench, supplying and installing of the manhole base with sump, conical or slab top, grade rings, benching the manhole floor, mortaring of joints and water proofing, the supplying, installing and adjusting to final grade of manhole frames and covers of the type specified, flushing, backfilling with approved material and compacting to the specified density beyond the standard trench, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **each** manhole frame, cover, top and base, of the type specified, supplied and installed.

Measurement: Each.

5.0 SUPPLY AND INSTALL INSULATED BLEEDER, MAIN TO MANHOLE

Payment for this item shall be compensation in full for locating existing water main and sanitary manholes, supplying and compacting the specified bedding and pipe zone material, tapping of the water main, supplying and installing main stops and curb stops of the size specified, supplying and installing service saddles, curb boxes and extensions set to grade, curb stop bases, nelson boxes, break-in, repair of manholes, concrete, grouting, benching, jack hammering out existing concrete benching, re-mortaring of joints and benching, water proofing, as required, flushing and cleaning after connection, supplying and installing service pipe of the size and type specified with approved factory insulation and heat trace channel and wire from the main to the manhole including stubs into the manhole, supplying and applying field insulation kits, heat shrink sleeves, insulated goosenecks, couplings, laying and jointing, squirt test in the presence of the Engineer, backfilling with approved material, moisture conditioning, compacting to the specified density, grading, clean-up, culling and disposal of oversize and or excess materials and waste to an approved disposal site, cleaning, testing, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price for **each** bleeder service installed.

Measurement: Each.

6.0 SUPPLY AND INSTALL FROST COVER

Payment for this item shall be compensation in full for the supplying of all materials, labour, equipment, fabrication, fasteners and hardware necessary to supply and install frost covers and spray foam insulation on the exterior of the manhole as specified in the engineering drawings, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid for **each** frost cover installed.

Measurement: Each.

7.0 TV. INSPECTION AND REPORTING

Payment for this item shall be compensation in full for the supplying of labour, equipment, and materials to conduct the television video inspections, as described in the specifications, flushing, stringing the line, video inspections, still photos, preparation and submission of one copy of the video on a USB stick, and preparation and submission of two copies of a written TV inspection report, and any other incidental work for which payment is not specified elsewhere.

The Engineer shall witness the TV inspection as it is being completed. All requests by the Engineer for specific viewing of items during the inspection shall be included in the cost of the services.

Payment: Tendered **Lump Sum** price bid for the sewer TV inspection of the entire sewer system within the project area regardless the number of time completed.

Measurement: Lump sum at Substantial Completion.

8.0 CONNECTION TO EXISTING MANHOLE OR CHAMBER

Payment for this item shall be compensation in full for excavating to the required depth and width beyond the standard trench, disposal to an approved site of any oversize or excess excavated material, shoring, de-watering, eduction and disposal to an approved location of sewerage, trench maintenance, locating existing manholes, pipes and chambers, break-in, repair of manholes, concrete, grouting, benching, hack hammering out existing concrete benching, re-mortaring of joints and benching, water proofing, as required, flushing and cleaning after connection, backfilling with approved material and compacting to the specified density beyond the standard trench, and any other incidental work, including coordination with the City of Whitehorse Utilities Department, for which payment is not specified elsewhere. All piping shall be paid under item 2.0

Payment: Tendered unit price for **each** connection to existing manhole or chamber completed.

Measurement: Each.

D. STORM SEWERS & OVERLAND DRAINAGE

1.0 TRENCHING AND NATIVE BACKFILL (All Depths and Widths) (PROVISIONAL)

Payment for this item shall be compensation in full for trenching to the specified depth, including the pipe zone, and width, shoring, de-watering, trench base preparation, trench maintenance, backfilling, moisture conditioning, compacting to the specified density, grading, clean-up, culling and disposal of oversize and or excess materials, and any other incidental work for which payment is not specified elsewhere. This item will only be paid once, even if more than one pipe is placed in a common trench. Payment for this item shall be made in addition to payment for supplying and installing of storm sewer main.

Payment: Tendered unit price bid per **lineal metre** for the various depth ranges and number of pipes installed. Payment will be limited to 75% of lineal meters installed until satisfactory T.V. Inspection and Reporting is completed and reviewed by the Engineer.

Measurement: Length shall be measured in metres along the centreline of the pipe.

2.0 REMOVE AND REINSTALL STORM SEWER MAIN (PROVISIONAL)

Payment for this item shall be compensation in full for locating, excavating, removal of existing pipe, bedding, couplers, manhole mortar, loading, hauling, temporary stockpiling of pipe, unloading, stringing the pipe, laying and jointing to the specified line and grade of sewer main of the type, class and diameter specified, connection to manholes or catch basin manholes, supplying and placing of the specified bedding and pipe zone material, compacting the bedding and pipe zone material to the specified density, flushing and cleaning the pipe, and any other incidental work for which separate payment is not specified elsewhere. The price shall also include the additional costs for supplying, handling and installing insulated pipe where specified. The price paid shall not include trenching and backfilling.

Payment: Tendered unit price bid per **lineal metre** for each pipe type, class, diameter and bedding class removed and reinstalled. Payment will be limited to 75% of lineal meters installed until satisfactory T.V. Inspection and Reporting is completed and reviewed by the Engineer.

Measurement: Field measured in metres along the centreline of the pipe with no deductions for manholes from centre of manhole to centre of manhole or from the centre of a manhole to a required termination where applicable.

3.0 REMOVE AND REINSTALL MANHOLE BARRELS (PROVISIONAL)

Payment for this item shall be compensation in full for locating, excavating the trench wall to the depth and width specified beyond the standard trench, removal of existing barrels, loading, temporary stockpiling, unloading, and reinstalling of all barrels, O rings, safety platforms, connection of sewer pipe to the manhole, mortaring of joints flush to the wall and waterproofing as required, backfilling with approved material and compacting to the specified density beyond the standard trench, and any other incidental work for which payment is not specified elsewhere. Installation of trench plugs will be considered incidental to this work.

Payment: Tendered unit price bid per **each** barrel section removed and reinstalled regardless of barrel height.

Measurement: Each.

4.0 REMOVE AND REINSTALL MANHOLE FRAME, COVER AND BASE (PROVISIONAL)

Payment for this item shall be compensation in full for locating, excavating the trench wall to the depth and width specified beyond the standard trench, removal of existing base, loading temporary stockpiling, unloading, and reinstalling of the manhole base with sump, conical or slab top as specified, grade rings, benching the manhole floor, mortaring of joints and water proofing, reinstalling and adjusting to final grade of manhole frames and covers of the type specified, flushing, backfilling with approved material and compacting to the specified density beyond the standard trench, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **each** manhole frame, cover, top and base, of the type specified, removed and reinstalled.

Measurement: Each.

5.0 REMOVE AND REINSTALL CATCH BASIN (PROVISIONAL)

Payment for this item shall be compensation in full for locating, excavating the trench wall to the depth and width specified beyond the standard trench, removal of existing catch basin, loading, temporary stockpiling, unloading, and reinstalling of catch basin barrels, O rings, connection of sewer pipe to the catch basin, reinstalling of the catch basin base with sump, grade rings, mortaring of joints flush to the wall and water proofing, reinstalling and adjusting to final grade of catch basin frames and covers of the type specified, flushing, backfilling with approved material and compacting to the specified density beyond the standard trench, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **each** catch basin, frame and cover, of the type specified, supplied and installed.

Measurement: Each.

6.0 SUPPLY AND INSTALL CATCH BASIN LEAD (PROVISIONAL)

Payment for this item shall be compensation in full for locating, removal of existing leads, trenching to the specified depth, shoring, dewatering, trench maintenance, loading, temporary stockpiling, unloading, hauling, stinging the pipe, laying and jointing to the specified line and grade of catch basin lead of the type, class and diameter specified, connection to manholes, catch basin manholes, catch basin or sewers, bracing, supplying and placing of the specified bedding and pipe zone material, compacting the bedding and pipe zone material to the specified density, backfilling, moisture conditioning, compacting to the specified density, grading, clean-up, culling and disposal of oversize and/or excess materials, flushing the pipe, and any other incidental work for which separate payment is not specified elsewhere. The price shall also include the additional costs for handling and installing insulated pipe where specified.

Payment: Tendered unit price bid per **lineal metre** for each pipe type, class, diameter and bedding class removed and reinstalled.

Measurement: Field measured along the top of pipe from the centre of the catch basin to the centre of the sewer or manhole at the point of connection.

7.0 TV. INSPECTION AND REPORTING

Payment for this item shall be compensation in full for the supplying of labour, equipment, and materials to conduct the television video inspections, as described in the specifications, flushing, stringing the line, video inspections, still photos, preparation and submission of two copies of the USB or Optical Disc, and preparation and submission of two copies of a written TV inspection report, and any other incidental work for which payment is not specified elsewhere.

The Engineer shall witness the TV inspection as it is being completed. All requests by the Engineer for specific viewing of items during the inspection shall be included in the cost of the services.

Payment: Tendered **Lump Sum** price bid for the TV inspection of the entire storm sewer system within the project area regardless of number of inspections.

Measurement: Lump sum at Substantial Completion.

E. WATER & SEWER SERVICE CONNECTIONS

1.0 TRENCHING AND NATIVE BACKFILL TO NEW MAIN (All Depths and Widths)

Payment for this item shall be compensation in full for trenching to the specified depth, including the pipe zone, and width, shoring, de-watering, trench maintenance, backfilling, moisture conditioning, compacting to the specified density, grading, clean-up, culling and disposal of oversize and or excess materials, and any other incidental work for which payment is not specified elsewhere. This item will only be paid once, even if more than one pipe is placed in a common trench. Payment for this item shall be made in addition to payment for supplying and installing of services pipes.

Payment: Tendered unit price bid per **lineal metre** of service trench.

Measurement: Length shall be measured in metres along the centreline of the longest service pipe in the trench.

2.0 TRENCHING AND NATIVE BACKFILL TO EXISTING MAIN (All Depths and Widths)

Payment for this item shall be compensation in full for trenching to the specified depth, including the pipe zone, and width, shoring, de-watering, trench maintenance, crossing existing deep and shallow utilities, replacing of existing road structure at service location, backfilling, moisture conditioning, compacting to the specified density, grading, clean-up, culling and disposal of oversize and or excess materials, and any other incidental work for which payment is not specified elsewhere. This item will only be paid once, even if more than one pipe is placed in a common trench. Payment for this item shall be made in addition to payment for supplying and installing of services pipes.

Payment: Tendered unit price bid per **lineal metre** of service trench.

Measurement: Length shall be measured in metres along the centreline of the longest service pipe in the trench.

3.0 INSULATED WATER SERVICE AND RECIRCULATION PIPE (NEW Main)

Payment for this item shall be compensation in full for supplying and compacting the specified bedding and pipe zone material, supplying and installing service and recirculation pipe of the size and type specified with approved factory insulation from the main to the property line, supplying and applying field insulation kits, heat shrink sleeves, couplings, laying and jointing, supplying and installing painted marker posts, squirt test in the presence of the Engineer, cleaning, testing, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **lineal metre** for combined water and recirculation lines. No separate payment will be made for the recirculation line.

Measurement: Field measured in metres along the centreline of the pipe with no deductions for valves or fittings.

4.0 INSULATED WATER SERVICE AND RECIRCULATION PIPE (EXISTING MAIN)

Payment for this item shall be compensation in full for supplying and compacting the specified bedding and pipe zone material, locating services on the existing main, supplying and installing service and recirculation pipe of the size and type specified with approved factory insulation from the main to the property line, supplying and applying field insulation kits, heat shrink sleeves, couplings, laying and jointing, supplying and installing painted marker posts, squirt test in the presence of the Engineer, cleaning, testing, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **lineal metre** for combined water and recirculation lines. No separate payment will be made for the recirculation line.

Measurement: Field measured in metres along the centreline of the pipe with no deductions for valves or fittings.

5.0 MAIN STOP c/w SADDLE

Payment for this item shall be compensation in full for tapping of the water main, supplying and installing corporation/main stops of the size specified, supplying and applying field insulation kits, heat shrink sleeves and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid for **each** corporation stop supplied and installed.

Measurement: Each.

6.0 CURB STOP

Payment for this item shall be compensation in full for supplying and installing curb stops of the size specified, curb stop bases, valve boxes, supplying and applying field insulation kits, heat shrink sleeves where indicated, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid for **each** curb stop supplied and installed.

Measurement: Each.

7.0 SUPPLY & INJECTION OF NON-TOXIC GREASE INTO CURB STOP

Payment for this item shall be compensation in full for greasing of all water services regardless of size to empty lots with non-toxic grease, and any other incidental work for which payment is not specified elsewhere. Grease injection to be maximum 300 mm on supply side of curb stop.

Payment: Tendered unit price bid for **each** curb stop injected with grease.

Measurement: Each.

8.0 SUPPLY AND INSTALL SANITARY SERVICE PIPE (PVC SDR 28) (NEW MAIN)

Payment for this item shall be compensation in full for supplying and compacting the specified bedding and pipe zone material, supplying and installing service pipe of the size and type specified from the main to the property line, long radius bends, wyes, couplings, jointing, supplying and installing painted marker posts and any other incidental work for which payment is not specified elsewhere. Installation of any additional insulation for frost protection from other infrastructure will be considered incidental to this work.

Payment: Tendered unit price bid per **lineal metre** of each type and diameter of sanitary service installed.

Measurement: Field measured in metres along the centreline of the service from centre of main to end of pipe.

9.0 SUPPLY AND INSTALL SANITARY SERVICE PIPE (PVC SDR 28) (EXISTING MAIN)

Payment for this item shall be compensation in full for supplying and compacting the specified bedding and pipe zone material, locating services on existing main, supplying and installing service pipe of the size and type specified from the main to the property line, long radius bends, wyes, couplings, jointing, supplying and installing painted marker posts and any other incidental work for which payment is not specified elsewhere. Installation of any additional insulation for frost protection from other infrastructure will be considered incidental to this work.

Payment: Tendered unit price bid per **lineal metre** of each type and diameter of sanitary service installed.

Measurement: Field measured in metres along the centreline of the service from centre of main to end of pipe.

10.0 SANITARY SEWER SERVICE CONNECTIONS TO MAIN (PROVISIONAL)

Payment for this item shall be compensation in full for supplying and installing in-line tees as specified, connection to the main, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid for **each** connection regardless of size.

Measurement: Each.

11.0 SANITARY SEWER SERVICE CONNECTION TO MANHOLE (PROVISIONAL)

Payment for this item shall be compensation in full for installation and connection of a sanitary service to manhole including benching and sealing around service pipe.

Payment: Tendered unit price for **each** connection regardless of size.

Measurement: Each.

F. ROADWORKS

1.0 SUBGRADE PREPARATION

Payment for this item shall be compensation in full for scarifying, wind-rowing, moisture conditioning, culling and disposal of oversize materials to an approved disposal site, compacting to the specified density, shaping, fine grading, proof rolling, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square meter** prepared.

Measurement: Field measurement and area calculated. The area measured shall be under the paved roadway and curb, gutter and 300 mm beyond curb, gutter, the full width of paved lanes, and the width of paved walkways. Subgrade preparation below sidewalks and crossings shall be included in the tendered price for separate sidewalk or crossing.

2.0 GRANULAR SUB-BASE COURSE (50 mm CRUSH)

Payment for this item shall be compensation in full for supplying, crushing, loading, hauling, placing, spreading, moisture conditioning, shaping, compacting to the specified density, the compacted depth of granular sub-base specified, clean up, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square meter** of the specified depth and gradation placed.

Measurement: For area, field measured and area calculated. The width measurements shall be based on actual width or design width which ever is less. The area measured shall be under the paved roadway and curb, gutter and 300 mm beyond curb, gutter, the full width of paved lanes, and the width of paved walkways.

Granular sub-base below crossings shall be included in the tendered price bid for the commercial crossing.

3.0 GRANULAR SUB-BASE COURSE (PIT RUN)

Payment for this item shall be compensation in full for supplying, crushing, loading, hauling, placing, spreading, moisture conditioning, shaping, compacting to the specified density, the compacted depth of granular sub-base specified, clean up, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **cubic meter**.

Measurement: Volume will be determined by cross sectional measurements taken by the Engineer after placing of material at 25 m intervals, plus additional sections as required. These cross sections will be used to derive the quantity based on the average end area method.

There will be no allowance made in the measurement or payment of this item for bulking or shrinkage of material.

4.0 COMMON EXCAVATION TO REUSE

Payment for this item shall be compensation in full for excavating, separating, ripping, loading, hauling, temporary storage, clean up, re-using the material for forming of embankments or backfilling excavation site to the designated grade and cross section including fill behind concrete structures and drainage ditches, compacting to the specified density , moisture conditioning the material as required, culling and disposal of oversized cobbles and boulders, to an approved disposal site, trimming, finishing and shaping including minor excavating, trimming and shaping of boulevards, disposal of excess and waste materials at approved locations and any other incidental work for which payment is not specified elsewhere.

Payment for excavating below design grade will be made only if the Contractor has been instructed by the Engineer to excavate below that elevation. Unauthorized over excavation will be replaced with acceptable materials and compacted to the specified density at no cost to the Owner.

Payment: Tendered unit price bid per **cubic metre.**

Measurement: Volume will be determined by cross sectional measurements taken by the Engineer before and after excavation at maximum 25 m intervals, plus additional sections as required, taken along the centre line of the road extending out to the property lines and or construction and or clearing limits. These cross sections will be used to derive the common excavation quantity based on the average end area method.

There will be no allowance made in the measurement or payment of this item for bulking or shrinkage of material.

5.0 COMMON EXCAVATION TO ONSITE STOCKPILE

Payment for this item shall be compensation in full for excavating, separating, ripping, loading, hauling, stockpiling, clean up, culling and disposal of oversized cobbles and boulders, to an approved disposal site, trimming, finishing and any other incidental work for which payment is not specified elsewhere.

Payment for excavating below design grade will be made only if the Contractor has been instructed by the Engineer to excavate below that elevation. Unauthorized over excavation will be replaced with acceptable materials and compacted to the specified density at no cost to the Owner.

Payment: Tendered unit price bid per **cubic metre.**

Measurement: Volume will be determined by cross sectional measurements taken by the Engineer before and after excavation at maximum 25 m intervals, plus additional sections as required, taken along the centre line of the road extending out to the property lines and or construction and or clearing limits. These cross sections will be used to derive the common excavation quantity based on the average end area method.

There will be no allowance made in the measurement or payment of this item for bulking or shrinkage of material.

6.0 LOT GRADING REUSE FROM ONSITE STOCKPILE

Payment for this item shall be compensation in full for excavating, separating, ripping, loading, hauling, temporary storage, clean up, using the material for onsite lot fil or backfilling excavation site to the designated grade and cross section including fill behind concrete structures and drainage ditches, compacting to the specified density , moisture conditioning the material as required, culling and disposal of oversized cobbles and boulders, to an approved disposal site, trimming, finishing and shaping including minor excavating, trimming and shaping of boulevards, disposal of excess and waste materials at approved locations and any other incidental work for which payment is not specified elsewhere.

Payment for excavating below design grade will be made only if the Contractor has been instructed by the Engineer to excavate below that elevation. Unauthorized over excavation will be replaced with acceptable materials and compacted to the specified density at no cost to the Owner.

Payment: Tendered unit price bid per **cubic metre.**

Measurement: Volume will be determined by cross sectional measurements taken by the Engineer before and after excavation at maximum 25 m intervals, plus additional sections as required, taken along the centre line of the road extending out to the property lines and or construction and or clearing limits. These cross sections will be used to derive the common excavation quantity based on the average end area method.

There will be no allowance made in the measurement or payment of this item for bulking or shrinkage of material.

7.0 RIP RAP COMPLETE WITH GEOTEXTILE (PROVISIONAL)

Payment for this item shall be compensation in full for all labour, material, equipment, for producing, supplying, loading, transporting, storing, joining and placing all geotextile and rip rap to the lines, depth and grades shown, clean-up and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square meter** of the specified depth.

Measurement: For area, field measured, and area calculated. The width measurements shall be based on actual width or design width which ever is less.

8.0 TOPSOIL & HYDROSEEDING (PROVISIONAL)

Payment for this item shall be compensation in full for all labour, material, equipment, incurred to prepare subgrade as specified, supply, haul and place top soil and hydroseed to depths and mix shown in the design drawings and details. As part of this line item, work shall also include the removal of any debris and rocks 100 mm and larger prior to the placement of Top Soil. Costs shall also include any and all fees related to clean-up and incidental work as necessary.

Payment: Tendered unit price bid per **square metre** for the specified top soil and hydroseed at the required depth.

Measurement: Field survey measured and area calculated.

9.0 GRANULAR BASE COURSE (20 mm Crush)

Payment for this item shall be compensation in full for supplying, crushing, loading, hauling, placing, spreading, moisture conditioning, shaping, compacting to the specified density, the compacted depth of granular sub-base specified, proof rolling, clean up, and any other incidental work for which payment is not specified elsewhere.

The granular base course beneath sidewalks and crossings shall be included in the price bid for separate sidewalks or crossings.

Payment: Tendered unit price bid per **square meter** of the specified depth and gradation placed.

Measurement: For area, field measured and area calculated. The width measurements shall be based on actual width or design width which ever is less. The area measured shall be under the paved roadway and curb, gutter and 300 mm beyond curb, gutter, the full width of paved lanes, and the width of paved walkways.

Granular base below crossings and sidewalks shall be included in the tendered price bid for the commercial crossing.

10.0 SIDEWALK

Payment for the specified width of sidewalk (separate & mono), shall be compensation in full for shaping and grading, sub-grade preparation, supply and placing granular base coarse as specified and native fill behind sidewalk or within boulevard, compacting to the specified density, machine pouring and/or hand forming, supplying and placing concrete including cold weather concrete requirements, supplying and placing reinforcing steel including drilling and epoxying of dowels into existing concrete and/or placing of dowels in new concrete, jointing, jointing material, finishing, stripping of forms, curing, sealing, backfilling as specified, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square meter** of sidewalk width specified and installed.

Measurement: Field measured along the centre of sidewalk excluding commercial crossings.

11.0 CONCRETE CURB AND GUTTER – ROLLED CURB

Payment for the specified type of concrete curb and gutter, including normal and reverse gutter, bull noses, shall be compensation in full for excavating, supplying and placing levelling course, compacting to the specified density, machine pouring and/or hand forming, supplying and placing concrete including cold weather concrete requirements, supplying and placing reinforcing steel including drilling and epoxying of dowels into existing concrete and/or placing of dowels into existing concrete and/or placing dowels in new concrete, jointing, jointing material, finishing, stripping of forms, curing, sealing, backfilling between curb and sidewalk as specified, and any other incidental work for which payment is not specified elsewhere.

Reinforced curb for Commercial Crossings shall be paid for under Commercial Crossings.

Payment: Tendered unit price bid per **linear meter** of curb type specified installed.

Measurement: Field measured along the face of curb not including the reinforced curb that runs through commercial crossings.

12.0 COMMERCIAL LANE CROSSINGS & BUS PADS

Payment for commercial crossing of curb and sidewalks, shall be compensation in full for excavating, subgrade preparation, supplying and placing base course, compacting to the specified density, hand forming, supplying and placing concrete including cold weather concrete requirements, supplying and placing reinforcing steel including drilling and epoxying of dowels into existing concrete and or placing of dowels in new concrete, jointing, jointing material, finishing, stripping of forms, curing, sealing, backfilling as specified, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square meter** of commercial crossing for the crossing width installed. Payment includes reinforced curb section of crossing

Measurement: Field measured along the back of commercial crossing.

13.0 PARA-RAMPS

Payment for para-ramps shall be compensation in full for additional labour for shaping, troweling, and finishing of the para-ramps in the concrete sidewalk and curb, including the depressing of curb sections as required.

Payment: Tendered unit price bid for **each** para-ramp.

Measurement: Each.

14.0 CONCRETE SWALE

Payment for concrete swale, shall be compensation in full for excavating, subgrade preparation, supplying and placing pit run sub-base, granular sub-base and base course, compacting to the specified density, hand forming, supplying and placing concrete including cold weather concrete requirements, supplying and placing reinforcing steel including drilling and epoxying of dowels into existing concrete and or placing of dowels in new concrete, jointing, jointing material, finishing, stripping of forms, curing, sealing, backfilling as specified, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square meter** of concrete swale installed.

Measurement: Field measured, and area calculated

15.0 CUTTING AND REMOVAL OF CONCRETE CURB AND GUTTER (PROVISIONAL)

Payment for this item shall be compensation in full for saw cutting the curb and gutter where directed, jack-hammering, breaking up, loading, hauling, unloading at an approved disposal site the removed curb and gutter, protection of abutting asphalt pavement, concrete, appurtenances, and any other work for which payment is not specified elsewhere.

Payment: Tendered unit price per **lineal meter** of cub and gutter removed.

Measurement: Field measured along the face of curb.

16.0 CUTTING AND REMOVAL OF CONCRETE SIDEWALK (PROVISIONAL)

Payment for this item shall be compensation in full for saw cutting the sidewalk where directed, jack-hammering, breaking up, loading, hauling, unloading at an approved disposal site the removed concrete and reinforcement, protection of abutting asphalt pavement, concrete, appurtenances, and any other work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square metre** removed.

Measurement: Field measured and area calculated.

17.0 WARM MIX ASPHALT PAVEMENT

Payment for this item shall be compensation in full for tacking structures, concrete gutter faces and appurtenances; adjustment of appurtenances, supplying asphalt, mixing, hauling, placing, rolling, compacting to the specified thickness and density, all labour, equipment, and materials required to complete the work, clean-up, and any other incidental work for which payment is not specified elsewhere, **including supply and installation of prime coats or tack coats**.

Warm mix asphalt concrete shall be produced by combining aggregates with asphalt cement modified by adding one of several additives, tested and proven in the production of warm mix asphalt (e.g. Aspha-min zeolite, Sasobit, or Evotherm), and shall have the same after-compaction physical properties as hot mix asphalt.

Compacted asphalt thickness up to and including 75 mm can be placed in one lift. Asphalt thickness greater than 75 mm shall be placed in two lifts. There will be no additional compensation for placing the two lifts of asphalt.

Payment: Tendered unit price bid per **square meter** for each specified thickness of asphalt placed.

Measurement: Field measured, and area calculated.

18.0 CUTTING AND REMOVAL OF ASPHALTIC CONCRETE (PROVISIONAL)

Payment for this item shall be compensation in full for saw cutting of asphalt to the required depth, jack-hammering, breaking up, loading, hauling, unloading at an approved Asphalt Recycling disposal site the removed asphaltic concrete, protection of abutting asphalt pavement, structures, concrete and appurtenances, all labour, equipment and materials required to complete the work, clean up, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square metre** removed.

Measurement: Field measured and area calculated.

19.0 PAINTED PAVEMENT MARKINGS – CROSSWALKS, RAISED CROSSING, STOP BARS, AND BIKE SYMBOLS (PAINTED)

Payment for this item shall be compensation in full for coordination, layout of lane markings, traffic control, supplying and installing painted markings to the specified width and colour, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit bid price for **each** type of painted item.

Measurement: Each.

20.0 INSTALL NEW STREET SIGN POSTS (PROVISIONAL)

Payment for this item shall be compensation in full for the supply and erection of all road signs post, including post and breakaway requirements, specified in the design drawings or any additional signs as specified by the Engineer, excavation, backfilling, and all other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit bid price for **each** sign post installed.

Measurement: Each.

21.0 INSTALL NEW STREET REGULATORY & IDENTIFICATION SIGNS (PROVISIONAL)

Payment for this item shall be compensation in full for the supply and erection of all road signs, mounting requirements, specified in the design drawings or any additional signs as specified by the Engineer, excavation, backfilling, and all other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit bid price for **each** sign installed.

Measurement: Each.

22.0 HYDRANT BOLLARDS (PROVISIONAL)

Payment for this item shall be compensation in full for supplying an approved steel bollards as specified, loading, hauling, unloading, hole auguring, installation, painting, concrete fill and encasement, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid for **each** bollard installed as detailed.

Measurement: Each.

G. SHALLOW UTILITIES

1.0 TRENCHING AND BACKFILLING - PROVISIONAL

Payment for this item shall be compensation in full for trenching to the specified depth, including the pipe zone, and width, shoring, de-watering, trench maintenance and removal of unsuitable trench bottom, backfilling, moisture conditioning, compacting to the specified density and any other incidental work for which payment is not specified elsewhere. This item will only be paid once, even if more than one pipe is placed in a common trench.

All trenches below or crossing sidewalks, curbs, gutters, lanes, walkways and roadway shall be compacted to 98% SPD (Class 2 Backfill).

Payment shall also include final shaping and grading to restore surface to proposed rough grade and shall include hauling and disposal of excess trench excavation as required.

This item will only be paid once, regardless of the number of conduit in a trench.

Payment: Tendered unit price bid per **lineal metre** of trench.

Measurement: Length shall be measured in metres along the centerline of the trench.

2.0 STREET LIGHT BASES - PROVISIONAL

Payment for this item shall be compensation in full for loading, transporting to the site, unloading, excavating, supplying and placing of bedding, installation of the ATCO Yukon Electric supplied concrete bases for 6.0, 9.0m or 12.0m street lights to the proper grade, backfilling with approved material, compacting to the specified density, coordination of all aspects of the supply and installation work with ATCO Electric Yukon, inspection and certification by an ATCO Electric Yukon Inspector, all labour, equipment and materials required to complete the work, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **each** street light base installed.

Measurement: Each.

3.0 INSTALL ATCO ELECTRIC YUKON AND NORTHWESTEL SUPPLIED CONDUIT - PROVISIONAL

Payment for this item shall be compensation in full for loading, transporting, unloading, excavating, supplying and installing bedding, new conduits regardless of number, connections to existing, caps for stubs, conduit blowing and cleaning, pull string inside the conduit, laying and jointing, supplying and placing concrete, backfilling with approved material, compacting to the specified density, supplying and placing warning tape, coordination with ATCO Electric Yukon and Northwestel, inspection and certification by an ATCO Electric Yukon Inspector, all other labour, equipment and materials required to complete the work, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **lineal meter** for conduit(s), regardless of number, installed and approved by ATCO Electric Yukon and NorthwesTel Inspectors. Trenching and backfill paid under a separate item.

Measurement: Field measured along centre line from centre of davit to centre of davit, existing power pole, or end of pipe.

4.0 INSTALL ATCO ELECTRIC YUKON AND NORTHWESTEL SUPPLIED TRANSFORMER BASES, PEDESTAL BASES, OR OTHER STRUCTURES – PROVISIONAL

Payment for this item shall be compensation in full for loading, transporting to the site, unloading, excavating, confirming duct ownership, tie-in to existing cables or conduits, installation of transformer bases, vaults, Pencells, joint use pedestals, individual pedestals, manholes and/or other structures to the proper grade, extra excavation or backfilling with approved material, compacting to the specified density.

It shall also include co-ordination of all aspects of the supply and installation work with utility companies (ATCO Yukon Electric. and NorthwesTel Inc.), inspection and certification by NorthwestTel and ATCO Electric Yukon Inspectors, and all labour, equipment and materials required to complete the work, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **each** type of transformer base, vault, Pencell, joint use pedestal, pedestal, manhole or other structure installed, or existing duct bank ends or structure connected to.

Measurement: Each.

5.0 CROSSING OF SHALLOW UTILITIES (PROVISIONAL)

Payment for this item shall be compensation in full for locating, exposing, supporting during installation of deep utilities or removal and replacement, backfilling with approved material, Supply and installation of concrete, compacting to the specified density of existing shallow utility infrastructure in coordination with ATCO Electric Yukon or NWTel, all labour, equipment and materials required to complete the work, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid **per each** crossing of existing shallow infrastructure. If multiple conduits are located within 1.0m of each other at a crossing they will be considered one crossing.

Measurement: Each.

H. PROVISIONAL ITEMS

All items within Section H. are considered Provisional items.

1.0 UNSUITABLE TRENCH MATERIAL REPLACEMENT

Payment for this item shall be compensation in full for any loading, hauling and disposal of unsuitable trench material to an approved site, supplying, hauling and placing approved imported granular fill, shoring, de-watering, trench maintenance, and all incidental work for which separate payment is not specified elsewhere. Excavation and removal of waste material below the pipe zone will be paid under Unsuitable Trench Foundation Material Replacement. Excavating unsuitable material and compacting imported fill will be paid under Trenching and Native Backfill.

Payment: Tendered unit price bid per **cubic metre**.

Measurement: Volume will be determined by cross sectional measurements taken by the Engineer before and after removal of the unsuitable material at maximum 25 m intervals plus additional sections as required within the trench area. These cross sections will be used to derive the trench material replacement quantity based on the average end area method.

2.0 UNSUITABLE TRENCH FOUNDATION MATERIAL REPLACEMENT

Payment for this item shall be compensation in full for excavating the unsuitable or unstable trench bottom material and disposal of same to an approved site, for supplying and hauling the approved imported granular material to the site, placing, compacting to the specified density, shoring, de-watering, trench maintenance, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **cubic metre**.

Measurement: Volume of the material used shall be computed from the actual length and depth, below the pipe zone, specified by the Engineer, and the width which shall be the trench width as specified in the engineering drawings or the actual trench width, whichever is less; or

Volume of the material shall be computed by truck box count as removed from the trench with the application of a shrinkage factor as determined by the Engineer.

3.0 EXCAVATION OF BOULDERS

Payment for this item shall be compensation in full for excavating, removing, hauling and disposal of rocks and boulders 200 mm diameter or greater to an approved site and any other incidental work for which payment is not specified elsewhere. Excavation of boulders less than 200mm diameter shall be considered incidental to Trenching and Native Backfill.

Payment: Tendered unit price bid per **each Truck Box** (Standard 8 cubic metres box).

Measurement: Each (measurement of full loads and partial last load).

4.0 SUPPLY AND INSTALL TRENCH BOTTOM GEOTEXTILE

Payment for this item shall be compensation in full for all labour, equipment and materials associated with the supplying, transporting, handling, placing, joining in accordance with the specifications, overlapping, and any incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square metre** installed.

Measurement: Field measured and area calculated excluding overlap.

5.0 SUPPLY AND INSTALL SANITARY SERVICE RISERS c/w BENDS (PVC SDR 28)

Payment for this item shall be compensation in full for the supplying all labour, equipment and materials necessary to supply and install service risers with bends as per the specifications, and any other incidental work for which payment is not already specified. Payment for sanitary service risers shall be paid for as an addition to Supply and Install Sanitary Service Main to 3m Beyond Property Line.

Payment: Tendered unit price bid per **vertical metre** supplied and installed.

Measurement: Vertical measurement will be from obvert of main pipe to invert of the 45 degree long radius bend where connection is made to the sanitary.

6.0 COMMON EXCAVATION TO OFFSITE DISPOSAL

Payment for this item shall be compensation in full for selecting an approved offsite disposal site, all fees associated with disposal at offsite location, excavation, separating, ripping, loading, hauling to an offsite facility, disposal and shaping the disposal area, restoration to access roads as instructed by the Engineer and any other incidental work for which payment is not specified elsewhere.

Payment for excavating below design grade will be made only if the Contractor has been instructed by the Engineer to excavate below that elevation. Unauthorized over excavation will be replaced with acceptable materials and compacted to the specified density at no cost to the Owner.

Payment: Tendered unit price bid per **cubic metre.**

Measurement: Volume will be calculated as the difference between the total volume of common excavation and the volume of total embankment, as calculated by the Engineer. Cross sections at maximum 25 m intervals, plus additional sections as required will be taken along the centre line of the road, and onsite disposal stockpiles, extending out to the property lines and or construction and or clearing limits. These cross sections will be used to derive the common excavation and embankment volumes based on the average end area method.

There will be no allowance made in the measurement or payment of this item for bulking or shrinkage of material.

7.0 LOT GRADING IMPORT

Payment for this item shall be compensation in full for borrow site development, loading and hauling of the approved off-site borrow material, placing, spreading and shaping to the specified lines and grades, compacting to the specified density, constructing and maintaining access roads, clean up and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **cubic meter**.

Measurement: Volume, determined by cross sectional measurements taken by the Engineer before and after placement of the imported fill at maximum 25 m intervals plus additional sections as required. These cross sections will be used to derive the quantity based on the average end area method.

8.0 GRANULAR SUB-BASE COARSE

Payment for this item shall be compensation in full for supplying, crushing, loading, hauling, placing, spreading, moisture conditioning, shaping, compacting to the specified density, the compacted depth of granular sub-base specified, clean up, and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **cubic meter.**

Measurement: For volume, determined by cross sectional measurements taken by the Engineer before and after placement of the granular sub-base at maximum 25 m intervals plus additional sections as required. These cross sections will be used to derive the granular sub-base quantity based on the average end area method.

9.0 SUPPLY AND INSTALL 50mm THICK HI-40 RIGID INSULATION

Payment for this item shall be compensation in full for all labour, equipment and materials associated with the supplying, transporting, handling, placing, joining in accordance with the specifications, overlapping, and any incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **square metre** installed.

Measurement: Field measured and area calculated.

10.0 SUPPLY AND INSTALL CONCRETE LOCK BLOCKS

Payment for this item shall be compensation in full for supplying and installing, each lock block as shown on the engineering plans or as directed by the engineer, including measures required to protect asphalt if location is on a road and any other incidental work for which payment is not specified elsewhere.

Payment: Tendered unit price bid per **each Lock Block** installed

Measurement: Each

Part 1 General

1.1 ADMINISTRATIVE

.1 Representative of Contractor attending meetings will be qualified and authorized to act on behalf of Contractor.

1.2 PRE-CONSTRUCTION MEETING

.1 Owner, Consultant, Contractor, major Subcontractors, and field inspector(s) will be in attendance.

.2 A pre-construction meeting will be held at a location selected by the Owner at least one week prior to the arrival of any personnel, equipment, or materials on site.

.3 In addition to the requirements under General Conditions 2.0, the Contractor shall prepare a construction schedule prior to the pre-construction meeting.

1.3 PROGRESS MEETINGS

.1 During course of Work and at an interval identified during the pre-construction meeting by the Owner.

.2 Contractor, major Subcontractors involved in Work, Owner, and Consultant are to be in attendance.

.3 Consultant to record minutes of meetings and circulate to attending parties and affected parties not in attendance within one week.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS INCLUDED

.1 Construction schedule

.2 Shop drawings and product data.

.3 Samples

.4 Operating and maintenance manuals.

.5 Record drawings.

.6 Certificates.

1.2 ADMINISTRATIVE

.1 Provide to Consultant for review the submittals specified. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 At Consultant's request, prepare and submit schedule fixing the dates for submission and return of shop drawings, product data or samples.

.3 Do not proceed with Work affected by the submittal until review is complete.

.4 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and shall be considered rejected.

.5 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents and stating reasons for deviation.

.6 Verify that field measurements and affected adjacent Work are coordinated.

.7 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant review of submittals.

.8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.

.9 Keep one reviewed copy of each submission on Site.

1.3 CONSTRUCTION SCHEDULE

.1 Prepare schedule in the form of a horizontal bar chart.

.2 Provide a separate bar for each trade or operation in each work area and road. Show proposed progress of all activities for main work items and subtrades of Contract. Indicate labour levels, construction crews, plant and equipment to be employed for each activity. Show delivery dates of major pieces of equipment. Show submittal submission dates.

.3 Provide horizontal time scale identifying the first workday of each week.

.4 Submit schedules within 15 days after award of Contract.

.5 Consultant will review schedule and return reviewed copy within 10 days after receipt.

.6 Resubmit finalized schedule within 7 days after return of reviewed copy.

.7 Distribute copies of the finalized schedule to:

.1 Job site office
.2 Subcontractors
.3 Consultant
.4 Owner
.5 Other concerned parties

.8 Instruct recipients to report to Contractor, within 10 days, any problems anticipated by the timetable shown in the schedule.

.9 Schedule will be reviewed at all progress meetings.

.10 Revise and resubmit schedule within 5 days after notification by Consultant that previously reviewed schedule is not being met. Show changes in operations proposed to complete construction work within Contract Time.

.11 If, during course of work, Contract Time is extended, correct construction schedule to show revised commencement and completion dates of affected parts of work.

.12 Update and submit schedule with progress payment request. No progress payments will be approved until receipt of a schedule acceptable to Consultant.

1.4 WORK PLAN

.1 Provide Work Plan for each key activity, as requested by Consultant, to show construction methods. Relate Work Plan to activities shown on Construction Schedule.

.2 Revise and submit Work Plan as requested by Consultant.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Detail all shop drawings using the metric system. Prepare to a drafting standard equivalent to Contract drawings.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, wiring diagrams, panel layouts with bills of material, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Adjustments made on shop drawings by Consultant are not intended to change the Contract Amount. If adjustments affect the value of Work, state such in writing to Consultant prior to proceeding with Work.

.5 Make such changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.6 Maintain a complete Shop Drawing Record showing the review status of all shop drawings on the work. Provide Consultant with a copy of this record on a monthly basis or as requested by Consultant.

.7 Submittal submissions:

.1 Submit shop drawings and other submittals to Consultant for review with a Submittal Transmittal Form in a form acceptable to Consultant.

.2 For each submittal or submittal package, type or print the appropriate information on the form to fully describe the submittal(s) being sent for review.

.3 Number each transmittal form in sequential order, for record and tracking purposes.

.4 Sign the form in the space provided to acknowledge Contractor review of the submittal(s).

.5 Retain one photocopy of the form for filing and record purposes.

.6 Forward the form and the accompanying submittal(s) to Consultant.

.8 Submissions shall include:

.1 Date and revision dates.

.2 Project title and Associated Engineering project number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Apply shop drawing stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.9 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.10 Submittals will be returned with one or more of the following notations. Take action as noted:

.1 "REVIEWED" - Make and distribute additional copies as required for execution of Work.

.2 "REVISE & RESUBMIT" - Make the necessary revisions and resubmit revised drawings for review. Show the drawing number of the first such revised drawing and show the latest revision number applicable to the drawing by adding a suffix to the drawing number as - "REV. 1", "REV. 2", etc.

.3 "REVIEWED AS NOTED" – This notation indicates when Consultant has provided notations on the shop drawings that must be incorporated into the goods or work. Make and distribute additional copies as required for execution of the work.

.4 "NOT REVIEWED" - This notation indicates when Consultant has not reviewed the drawing. It may also be used in combination with the notation to revise and resubmit the drawing where Consultant lacks sufficient information to complete the review and requires to resubmit the drawing for review after revision.

.5 Drawings will be marked "REVIEWED" together with the notation to "REVISE & RESUBMIT" when Consultant requires Contractor to resubmit a revised drawing showing corrections made as a result of Consultant's notations on the shop drawings. This procedure will not relieve Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of Contract.

.11 Use only those shop drawings on the work that bear the "REVIEWED" notation.

.12 Do not revise shop drawings marked "REVIEWED" unless resubmitted to Consultant for further review.

.13 Where more than one type of shop drawing has been specified for one item, e.g., wiring diagrams, layout details, and dimensional drawings, the shop drawings shall be submitted together, to enable Consultant to review the drawings as a package.

.14 Catalogue pages or drawings applicable to an entire family or range of equipment will not be accepted as shop drawings unless they are clearly marked to show the pertinent data for the particular materials.

.15 Manufacturers' catalogues, manuals, or price lists will not be accepted as shop drawings. Such materials may be used as supplemental information to the shop drawings.

.16 Indicate the tag number of instruments and valves and clearly show the features and details applicable to the equipment being supplied.

.17 Determine which shop drawings have, in addition to those drawings specifically mentioned in the Contract, design elements requiring the seal of a Professional Consultant registered in the Province or Territory where the work is located, in accordance with the applicable provincial or federal engineering acts or other governing legislation. Seal such drawings before submitting them for review. Submit for review engineering calculations signed by the registered Professional Engineer responsible for the shop drawing design elements.

.18 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.19 Owner may deduct, from payments due to Contractor, costs of additional engineering work incurred if correct shop drawings are not submitted after one review by Consultant.

.20 Review by Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Consultant approves the detail design inherent in the shop drawings, responsibility for which remains with Contractor, and such review does not relieve Contractor of the responsibility for errors or omissions in the shop drawings or of the responsibility for meeting all requirements of the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at 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 sub-trades.

1.6 SAMPLES

.1 Submit for review samples as requested in respective specification Sections. Label samples as to origin and intended use in Work.

.2 Deliver samples prepaid to Consultant's Site Office.

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

.4 Adjustments made on samples by Consultant are not intended to change Contract Amount. If adjustments affect the value of Work, state such in writing to Consultant prior to proceeding with Work.

.5 Make changes in samples which Consultant may require, consistent with Contract Documents.

1.7 OPERATING AND MAINTENANCE MANUALS

.1 Submit operating and maintenance manuals to Consultant as requested.

END OF SECTION

Part 1 General

1.1 ENVIRONMENTAL PROTECTION PLAN

.1 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Consultant.

.2 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.3 Include in Environmental Protection Plan:

.1 Names and Contact Information of person(s) responsible for ensuring adherence to Environmental Protection Plan.

.2 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures follow Water Licence, if applicable, or other requirements established by Authority Having Jurisdiction. The erosion and sediment controls plan shall outline how existing ditches and/or stormwater infrastructure will be protected and maintained.

.3 Spill Contingency Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substances and sewage.

.4 Solid waste disposal plan identifying methods and locations for solid waste disposal, including clearing debris.

.5 Air pollution control plan detailing mitigation for dust migration.

.6 Waste Water Management Plan identifying methods and procedures for management of discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines. Waste Water Management Plan to be in accordance with Water Licence, if applicable, and requirements established by Authority Having Jurisdiction.

1.2 FIRES

.1 Fires and burning of rubbish, clearing or grubbing debris is not permitted.

1.3 DRAINAGE AND DEWATERING

.1 Contractor shall keep all portions of the work well drained during the construction until Substantial Completion and will be held responsible for all damage which may be caused or result from snow, rain, water backing up or overflowing through, from or along any part of the Work which is directly resultant from Contractor's operations.

.2 Groundwater flows and soils with high moisture content have been encountered during construction of previous phases of the Whistle Bend subdivision. It is expected that groundwater and soils with high moisture will be encountered during construction. Contractors shall be prepared to dewater as required to complete the work, and allow for working soils with high moisture, prior to reuse, to reduce moisture content. Costs and related impacts shall be included in the applicable unit rates.

.3 Provide temporary drainage and pumping required to keep excavations and site free from water from any source.

.4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials and in accordance with the Authority Having Jurisdiction. Discharge into City of Whitehorse infrastructure shall have prior written authorization from the City of Whitehorse.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Water Licence, if applicable, and requirements established by Authority Having Jurisdiction.

1.4 WORK ADJACENT TO WATERWAYS

.1 Construction equipment to be operated on land only a minimum of 30 meters away from any waterways.

.1 Contractor shall submit a workplan outlining construction methods, environmental protection protocols and installations and when working within 30 m of any waterway.

.2 Where Work is occurring within 30 m of any waterway the Contractor shall retained a qualified environmental monitor to be onsite during all construction activities within the 30 m zone to monitor the Work to mitigate impacts to the waterway. Contractor shall take direction from the environmental monitor to address any actual or perceived impacts from the Work.

.2 Waterways to be kept free of excavated fill, waste material and debris.

1.5 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees, plants and vegetation on site and adjacent properties as indicated or directed by Consultant.

.2 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.

.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.

.3 Minimize stripping of topsoil and vegetation.

.4 Restrict tree removal to areas indicated on drawings and as directed by Consultant.

.5 Clearing shall be completed in accordance with Federal Migratory Birds Act and Regulations.

.1 No clearing shall occur between May 1 to August 30. If clearing is required during this period, pre-clearing bird surveys shall be conducted by a professional biologist to determine bird activity in the area.

.2 The Contractor shall not clear in the area until an approved plan has been submitted.

.3 Contractor shall retain and cover costs for pre-clearing bird surveys as required. Costs are considered incidental to the Work.

.6 Clearing required to be completed within 7 m of an ATCO Yukon Electric or Yukon Energy powerline must be completed by a certified Arborist approved by the powerline owner.

.7 Dispose of clearing, grubbing and stripping shall be disposed of offsite at a location approved by the Consultant.

1.6 SALVAGE FUEL WOOD

.1 The Contractor when clearing shall salvage wood for the purpose of personal use for the public.

.2 Trees to be salvage shall meet the following criteria.

.1 Coniferous and/or deciduous

.2 Greater than 15 cm diameter at a distance of 150 cm above ground.

.3 Limbed and toped at a diameter of 10 cm.

.3 Salvaged trees shall meet the following end product.

.1 Bolts bucked to an average length of 180 cm, no less than 150 cm and no greater than 210 cm.

.2 Hauled to a location within 5 km of the project site limits.

.3 Staked in rows no greater than 180 cm high

1.7 ESTABLISHED LANDSCAPING AND TREES

.1 No trees whatsoever shall be cut down by the Contractor without first notifying the Consultant and confirming that such removal is required for the Contractor to properly perform the work. Trees, shrubbery, fences, poles and other private property and surface structures shall be protected unless their removal is shown on the drawings or otherwise first confirmed by the Consultant. When it is necessary to cut roots and tree branches, such cutting shall be done after first notifying the Consultant and confirming that such cutting is required for the Contractor to properly perform the work.

1.8 DUST CONTROL

.1 Contractor shall provide dust control measures during the course of the contract with the use of water. There will be no payment for providing dust control; it will be considered an incidental obligation under the contract.

1.9 SPILLS

.1 Contractor shall ensure that sufficient clean-up equipment and material is on-site at all times and in a state of readiness to clean up all deleterious substances which may be spilled. Should a spill occur, the spill contingency plan shall immediately be implemented and the spill shall be reported to the Authority Having Jurisdiction and Consultant.

1.10 NOTIFICATION

.1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Territorial, Authority Having Jurisdiction or requirements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.

.1 Take action only after receipt of written approval by Consultant.

.3 Consultant may issue a stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

END OF SECTION

Part 1 General

1.1 INDEPENDENT TESTING

.1 The Owner may retain professional services for materials testing and quality assurance. The cost services will be borne by the Owner except for:

- .1 Those tests that prove the material or workmanship defective or deficient.
- .2 The additional testing undertaken after rectification to confirm compliance with specifications and unless otherwise specified herein.
- .3 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .4 Mill tests and certificates of compliance.
- .5 The cost of shop testing, plant inspection and the plant testing or witnessing.
- .6 Testing during granular material manufacturing.
- .7 Testing of granular materials as outlined in technical specifications.

.2 The Contractor shall bear the above costs not accepted by the Owner and the cost of sampling, materials, delivery to laboratory and service.

.3 The Contractor shall, at his/her own expense, carry out additional quality control testing to ensure compliance with specifications and to safeguard against substandard work that may be revealed later.

1.2 QUALITY ASSURANCE AND DOCUMENTATION

.1 The Contractor shall pay particular attention to utility grade and alignment control, for all underground utilities.

.2 The Contractor's survey personnel shall take as-built check shots on utilities as they are being installed, at the intervals identified in 01 71 00 – Examination and Preparation, or as required. Check shots shall be recorded at the end of each day on a set of redline as-built drawings which the Contractor maintains at the work site. The Contractor's field survey notes and as-built drawing mark-ups shall always be available for the Consultant's review.

.3 Where check shots indicate that utilities are outside of allowable tolerance, utilities shall be removed and re-graded before proceeding with any additional installations.

.4 The Contractor shall be solely responsible for checking grades, cross sections, and alignments.

.5 The Contractor shall submit up to date as-built check shots and red line markups monthly for Measurement and Payment purposes.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, offsite manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for access.

1.4 PROCEDURES

.1 Notify Consultant in advance (minimum 72 hours) of requirement for tests in writing in order that attendance and /or suitable documentation arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 If in opinion of Consultant, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct an amount that is 2 times the estimated value of the Work that is still to be satisfactory rectified, replaced, or preformed under the Contract from progress payments, as determined by Consultant. Such amounts will be released by the Owner upon the Owner verifying that the identified Work is complete, replaced and/or defects rectified.

1.6 REPORTS

.1 Submit copies of inspection and test reports to Consultant as requested.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

1.8 SEWER INSPECTION BY TELEVISION

.1 Inspection shall be carried out by a third-party independent contractor. The Prime Contractor or Sub-Contractor installing the sewer shall not be permitted to complete the inspection.

.2 The Contractor shall review sewer inspection footage and reports to ensure accuracy and completeness prior to submission. Submissions which are incomplete or inaccurate will not be reviewed by Consultant.

.3 The Contractor shall re-inspect sewers at the direction of the Consultant at no additional charge to the Owner. Such re-inspections include after any repairs, poor inspection quality, flushing of mains or as otherwise determined. All main shall be inspected prior to asphalt placement and again after asphalt placement at a minimum.

.4 Submission and satisfactory review of sewer inspection footage shall be required to meet Substantial Completion per GC 14.0.

1.9 WATER SYSTEM TESTING

.1 In additional to the requirements of Section 5, the Water System shall be undertaken in accordance with the City of Whitehorse Water Main Testing Procedures, latest edition.

.2 The Contractor shall submit a written plan for flushing, pressure testing and disinfection of the system 15 days prior to commencement for review. Plan shall include all calculations of flow rates, chlorination testing parameters and leakage loss calculations. Plans shall be sealed by a Professional Engineer licenced in the Yukon. The Professional Engineer shall be consulted to approve and field changes made by the Contractor.

.3 The Contractor shall be prepared and allow for costs to complete multiple water system flushing, pressure testing and disinfection tasks throughout the Contract based on seasonal shutdowns, system repairs, and/or direction from the Consultant.

END OF SECTION

Part 1 General

1.1 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in clean and orderly condition, lockable weatherproof storage for tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof storage on site in manner to cause least interference with work activities.

1.2 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.3 CONSTRUCTION SIGNAGE

.1 No other signs or advertisements, other than warning or owner-provided signs, are permitted on site.

.2 Maintain approved signs and notices in good condition for duration of project and dispose of off site on completion of project or earlier if directed by Owner and/or Consultant.

1.4 CONSTRUCTION WATER

.1 The Contractor shall supply and dispose of all water required for completion of the Work in accordance with the Authority Having Jurisdiction and borne all costs associated.

1.5 TEMPORARY ACCESS ROADS

.1 Temporary roads for access to the working areas may only be constructed in the rights-of-way if the Engineer consents to such temporary roads and has reviewed the location of such roads for conformance with the contract documents prior to construction. Adequate drainage facilities in the form of ditches, culverts, or other conduits shall be installed as necessary to maintain these roads. In the construction of access roads, existing drainage facilities shall, unless otherwise provided for elsewhere in the specification, be restored to their original condition on completion of the work. There will be no payment for providing temporary access roads as described above as this will be considered a subsidiary obligation under the contract.

1.6 METHOD OF HAULING

.1 All materials hauled on the travelled portion of any road beyond the vicinity of the work shall be hauled by truck only and shall not exceed legal weight loads.

.2 All haul routes shall be signed in accordance with the Authority Having Jurisdiction.

1.7 CLEAN-UP

.1 Provide snow removal during period of Work.

.2 Remove construction debris, waste materials, packaging material from work site daily.

.3 Clean dirt or mud tracked onto paved or surfaced roadways.

.4 Store materials resulting from demolition activities that are salvageable.

.5 Stack stored new or salvaged material not in construction facilities.

END OF SECTION

Part 1 General

1.1 UNITS OF MEASUREMENT

.1 This is a Metric Project. Plans and contract documents have been prepared in the SI Metric System. Initial layout measurements will be carried out in metric units.

1.2 SURVEY

.1 The Consultant will provide the coordinates of control point(s) within or near the project area for layout purposes. The Contractor shall confirm the coordinates and elevations of the points as accurate prior to commencing the Work. The Contractor shall provide the Consultant 10 days, excluding weekends, written notice to layout the control points.

.2 The Contractor shall preserve and protect the established reference points and shall not modify or relocate the established reference points without the approval of the Consultant. If the Contractor destroys the Consultant's survey points, and requires re-establishment of off-set control points, the Contractor shall pay for the re-survey as required.

.3 The Contractor shall keep all work activities within the defined working area unless specific agreements are negotiated with private property owners or Owner.

.4 Unless otherwise stated in the Contract Documents, the Contractor shall be responsible for:

.1 Establish all lines, grades, elevations, and related staking required to layout and complete the work.

.2 Checking of grades, alignments and cross sections.

.3 Checking of design and layout for conflicts requiring design adjustment.

.4 Supply of stakes, markers and related tools and equipment.

.5 Digital and redline drawing markup As-built records.

.5 The Contractor shall employ qualified and competent survey personnel to complete all necessary survey work during construction. The Contractor survey personnel shall be under the supervision of a qualified registered Canada Lands Surveyor or Professional Engineer registered in the Yukon, acceptable to the Owner.

.6 Regardless of the layout methodology, the Contractor shall verify the accuracy of the proposed location of the elements of the Work as indicated by the layout, prior to their construction, by measurements to legal property lines, either proposed or existing infrastructure and existing physical features at the Project Site.

.7 The Contractor shall review the proposed Work items and identify conflicts, grade issues and/or quantity concerns in writing to the Consultant 10 days prior to commencement of the specific Work item.

1.3 LEGAL MONUMENTS

.1 Any legal monuments, iron bars, etc. destroyed or disturbed during the work shall be restored by a Canada Land Surveyor at the Contractor's expense.

.2 The Contractor shall conduct a survey inventory by a Canada Land Surveyor 15 days prior to construction of all legal monuments in the area of Work. Provide record of legal monument inventory to the Consultant for records.

.3 Upon completion of the Work, the Contractor shall conduct a survey inventory by a Canada Land Surveyor of all legal monuments in the area of Work. Provide record of legal monument inventory to the Consultant for records. The Contractor shall replace any legal monuments, iron bars, etc. destroyed or disturbed during the work shall be restored by a Canada Land Surveyor at the Contractor's expense prior to Substantial Completion.

1.4 PROTECTION OF STAKES

.1 The Contractor to protect stakes. Where stakes are destroyed, either deliberately or through carelessness, they will be replaced at the Contractor's expense.

1.5 EXISTING UTILITIES

.1 The Contractor shall take note that there are existing overhead and underground utilities located adjacent to the work area. Damage to these utilities caused by the Contractor's operation shall be the Contractor's responsibility including payment for the repair, rectification and consequences of such damage.

.2 The Contractor shall be responsible for contacting the owners of all buried utilities to arrange for utility locates. This includes, but is not limited to, Owners of private property adjacent to the work area, Northwestel Inc., Yukon Energy Corporation, ATCO Yukon Electric and the local water and sewer utility.

.3 The Contractor shall be responsible for the location and protection of all existing utilities and appurtenances, including but not limited to, signs, power poles, streetlights, pad mount transformers, telephone pedestals, legal survey control monuments, buried utility conductors, and buried water, sanitary, and storm sewer mains. Extreme caution is to be exercised at all times, and damage is to be reported and repaired immediately. The costs associated with protection of and repair of all utilities shall be borne by the Contractor.

.4 Notify Consultant and utility companies of intended interruption of services and obtain required permission.

.5 Where Work involves breaking into or connecting to existing services, give Consultant and existing infrastructure owner 15 days of notice for necessary interruption of infrastructure or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions as required by infrastructure owner.

.6 Where Work requires plugging, diverting or bypass pumping of sanitary wastewater or storm sewer mains, all costs shall be borne by the Contractor.

1.6 EXISTING POLES & LAMPS

.1 Any poles that require moving, solely to facilitate the Contractor's operation shall be moved and replaced at the Contractor's expense.

.2 Any poles that require permanent relocation due to the new construction shall be moved at the Owner's expense. The Contractor shall provide the Owner 6 weeks advanced notice for permanent relocation requirements.

1.7 RECORD SURVEY

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a survey showing dimensions, locations, angles and elevations of Work.

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

.4 The consultant may request copies of the contractors field books to verify or confirm elevations of any or all infrastructure installed by the contractor.

.5 The Contractor shall provide the Consultant with a list of as-built point descriptors to be used for all digital data supplied for review. Contractor shall updated the list as required by the Consultant. The Consultant may return and request new digital files if point descriptors do not match approved list without prior written approval.

.6 Digital progress as-builts (excluding x-refs) and redline drawing markups shall be submitted to the Consultant monthly for the purpose of record keeping and measurement and payment. The as-built information as outlined in Table 1 will be required, Contractor shall confirm the survey density and methodology with Consultant for survey items prior to commencement. Submitted point groups shall be combined per the item list below in Table 1.

.7 Submit monthly certificate sealed by Surveyor certifying that elevations, locations and cross-sections of completed Work are in conformance with Contract Documents. Nonconforming Work will not be paid.

.8 Contractor shall submit Service Sheets, Valve Sheets and Hydrant Report Sheets in accordance with the City of Whitehorse Engineering Standards (Latest Edition) for all services, valves and hydrants within the project. All Service Sheets, Valve Sheets and Hydrant Report Sheets shall be completed by the surveyor and submitted prior to Substantial Completion.

Table 1 – Required as-built Information

Item	Frequency
Post Clearing	20m grid, high and low points, break points.
Post Grubbing and Stripping	20m grid, high and low points, break points.
Post Subgrade Prep	5 - 20 m, depending on road
Post Granular Sub-Base	5 - 20 m, depending on road
Post Granular Base	5 - 20 m, depending on road
Post Asphalt/BST	5 - 20 m, depending on road
Curb, Gutter, Sidewalk, Para-ramps	5 - 20 m, depending on road, lip of gutter, front and back of sidewalk (excluding commercial crossings, center of ramp
Commercial crossings	Lip of gutter to back of sidewalk at top of letdowns.

Other Concrete	All edges
Final Lot Grading	Property corners or maximum 20 m grid which ever is less distance.
Water main	Invert every 10 m, bends, valves, tees, crosses, and other fittings.
Hydrants	Invert, top flange, and center of hydrant.
Storm main & culverts	Invert every 10 m, ends.
Sanitary main	Invert Every 10 m
Manholes	Inverts, center of barrel, center of rim.
Water Service	Main Stops, Curb Stops (surface and invert), Bends, Stub invert
Sanitary Service	Saddles, Riser, Bends, Stub invert, clean out rim and invert
Line Paintings and symbols	All
Utility boxes: Pedestals, Transformer, Switch Modules, Etc.	All
Poles, anchors	All
Signs	Post
Light poles	All
Conduit	Every 10 m along center of bundle, bends, stubs.
Ditches	Cross section every 10m
Riprap	Perimeter, maximum 5m spacing
Topsoil	Perimeter, maximum 5 m spacing
Fence and Gates	Perimeter, maximum 5 m spacing, each gate
Bollards	Each

END OF SECTION

SECTION 00A – MOBILIZATION & DEMOBILIZATION

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00A.1 Scope

00A.1.1 Mobilization

Mobilization shall consist of the necessary work and operation including, but not limited to, the movement of personnel, equipment, supplies and incidentals to the Work, the establishment of offices, camps and other facilities necessary to undertake the Work and for expenses incurred for other work and operations which must be performed prior to the commencement of the Work.

00A.1.2 Demobilization

Demobilization shall consist of the necessary work to remove from the site those items that were mobilized, as well as all incidental items that were necessary to set-up or maintain those mobilized items, including cleanup and restoration of on and offsite infrastructure utilized by the contractor in the execution of their work that in the opinion of the engineer was subject to greater than normal wear and tear.

00A.2 Site

Site: the general location of the work, which may include areas both inside and outside the project limits.

SECTION 00B – TRAFFIC CONTROL

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00B.1.1 Scope

00B.1.1 Description

This section specifies the requirements for Traffic Control to guide traffic through or around the work.

00B.1.2 Reference Standard

Accommodate traffic within guidelines contained in the Manual of Uniform Traffic Control Devices for Canada, September 1998 and subsequent updates, Part D - Temporary Conditions (distributed by Transportation Association of Canada), except where specified otherwise. Nothing in this section shall limit the Contractor's responsibility to safely accommodate traffic in unique, unusual, or varied construction situations.

00B.2 Definitions

.1 Barricade — a device consisting of one to three horizontal rails and their supports, used to block traffic access. Similar barricade assemblies may be placed end to end. Barricades must be retroreflective, on both sides if necessary, in orange and black colours in approved pattern.

.2 Barricade light — a self-contained, high intensity, electrically powered flashing warning light (strobe) with a bi-directional yellow lens of not less than 175 mm in diameter.

.3 Buffer vehicle — a vehicle which typically follows behind a mobile work operation, and which is equipped with a minimum of an equipment warning light and 4-way flashers plus warning sign, or equipped with a flashing arrow board plus warning sign.

.4 Chevrons — a delineation device (450 mm x 600 mm sign), generally used to warn of abrupt changes in alignment, and may be used to supplement non-directional delineators.

.5 Cones — a delineation device that, when approved by the Engineer, may be used during daylight hours only to guide or channel traffic through a work area or a temporary hazardous condition.

.6 Construction marker — a delineation device (900 mm x 300 mm sign) with alternating retroreflective horizontal orange and black stripes.

.7 Delineation devices — used to channelize traffic or delineate obstructions, work areas, or a reduction in the effective width of the roadway. They may be used to supplement signs and barricades, and must be retroreflective.

.8 Drums — a delineation device made of flexible material, uniformly sized, and no less than 900 mm in height. They must be orange and white in colour, and retroreflective. Drums must contain only sufficient ballast to prevent movement by the wind.

.9 Equipment warning light — a unit which provides a rotating, oscillating, or

flashing amber light. The light source may be incandescent, strobe, or LED, and must be visible in daylight through 360 degrees in normal atmospheric conditions for a distance of one kilometre.

.10 Flashing beacon — an electrically powered flashing signal light with a yellow lens of not less than 200 mm in diameter.

.11 Floodlights — General area lighting for Traffic Control Person stations and other potentially hazardous locations. Floodlighting must of a type that prevents disabling glare to the Traffic Control Person, workers, and approaching road users, or be shielded or positioned to achieve this condition. Required illumination levels may vary with the type of hazard, but may not be less than 50 lux.

.12 Hazardous area or condition — any portion of the highway where a condition exists which could be particularly dangerous to road users or workers.

.13 Pilot vehicles — half-ton trucks or larger, supplied by the Contractor and equipped for duty of piloting.

.14 Traffic control device — a gateway assembly, sign, signal, barricade, delineation or channelization device, or other approved device placed upon, over or adjacent to a roadway which is intended to regulate, warn, or guide road users. All Traffic Control devices must be in accordance with the Manual of Uniform Traffic Control Devices for Canada, or as approved by the Engineer.

.15 Traffic Control Level — specifies the type and application of traffic control devices and workforce necessary to regulate traffic having regard to traffic volume, geometrics and type of work on the project.

.1 Level I — Supply, install and maintain the necessary signs, barricades, and delineation devices. Provide equipment warning lights, barricade lights, traffic signals, flashing beacons, or buffer vehicles. Level I is generally associated with weekends or other periods when the project is shut down, or with exclusively mobile operations.

.2 Level II — Supply Traffic Control Persons and additional traffic control devices as required. Level II is generally associated with work on the traveled roadway and shall be used whenever any machinery is working or crossing the traveled roadway (gravelling, earth moving, etc.) or when the normal roadway width is reduced.

.3 Level III — Maintain availability of a pilot vehicle, including service and operation, as required by the Engineer.

.4 Level IV — Provide a Traffic Control Supervisor with vehicle to supervise, maintain, and be responsible for traffic control.

.16 Traffic Control Person — a person trained and certified in traffic control procedures, and who typically controls traffic by means of hand-held traffic signs.

.17 Traffic Control Supervisor — a person trained and certified as a Traffic Control Supervisor, or equivalent training and certification as determined by the Engineer, responsible for instructing Traffic Control Persons and overseeing all elements of traffic control at the worksite.

.18 Traffic Facilitator — a person trained and certified in traffic control procedures, and who primarily acts as an intermediary with affected property owners, ensures the Engineer and Contractor's supervisor are appraised of the daily traffic control setup, and who acts as a contact person for all traffic control related issues.

.19 Traffic signals — an LED signal head consisting of red, amber and green lights with lenses of not less than 300 mm in diameter, used in pairs, properly timed to control traffic through the work area.

.20 Tubular markers — a type of delineation device made of flexible material, predominantly orange, not less than 700 mm high and 50 mm wide facing road users. For night-time use, tubular markers must be retroreflectorized with two 75 mm wide white bands placed a maximum of 50 mm from the top, with a maximum of 150 mm between the bands.

.21 Work area — any portion of the highway on which the Contractor's people and equipment are performing work. Two or more work areas separated by less than two kilometres will be considered as a single work area.

00B.3 Protection of Public Traffic

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

00B.4 List of Traffic Control Devices

.1 Meet with Engineer prior to commencement of work to prepare a list of signs and other devices required for project.

.2 Do not commence work until approved traffic control devices are in place.

.3 Prepare new list, approved by Engineer, if situation changes from the meeting discussed in .1 above.

.4 The Contractor is fully responsible to provide traffic protection for the various operations to complete the work. The Engineer's approval of the device list does not relieve the Contractor from responsibilities stated elsewhere in this Section.

00B.5 Execution

00B.5.1 General

.1 Traffic Control Plan

.1 A traffic control plan shall be prepared and implemented with the intent of ensuring safe passage through the work zone for all road users, and while minimizing delays and inconveniences to the traveling public.

.2 No work will be allowed to commence until the Engineer has reviewed and accepted the traffic control plan.

.3 Any significant deviations from the traffic control plan must be approved by the Engineer prior to implementation.

.4 The traffic control plan shall outline how the Contractor plans to operate equipment during the various stages of the construction, and how traffic control will be carried out during the various stages of construction, and provide the following minimum details:

.1 Accommodation plan for traffic at all times, including consideration of anticipated vehicle types,
.2 Accommodation of existing accesses and associated traffic,
.3 Accommodation of emergency vehicles,
.4 Incident response protocol,
.5 Type of light fixture, and installation details of lighting provided at Traffic Control Person stations and hazardous locations, and
.6 If specified in Section 01010, Project Scope and Special Requirements, provide and identify a Traffic Facilitator (not the Contractor's construction supervisor). The Traffic Facilitator must be approved by the Engineer. Duties of the Traffic Facilitator may include those that are not traffic related, but must include the following as a minimum:
.1 Discussing the daily work plan with Engineer and Contractor's superintendent
.2 Liaising with roadside facilities to ensure traffic control does not unduly hamper access to facilities, and acting as the contact person for all traffic related complaints or inquiries
.3 Ensuring that Traffic Control Persons are properly informed with regard to road conditions, located in an appropriate and safe location, and are relaying the proper information
.4 Ensuring traffic control meets requirements of Section 02010, Traffic Control, and standard drawings provided in the contract documents

.5 Other details as requested by the Engineer.

.6 The provision of the traffic control plan will be considered incidental to other Traffic Control bid items, and no separate payment will be made.

.2 Training

.1 Traffic Control Persons, and Traffic Facilitators when specified in Section 01010, Project Scope and Special Requirements, shall have a minimum requirement of current certification as a Traffic Control Person. This certification will be attained by successful completion of the Traffic Control Person training course offered through Yukon College, or equivalent training and current certification as determined by the Engineer.

.2 Traffic Control Supervisors shall have a minimum requirement of current certification as a Traffic Control Supervisor. This certification will be attained by successful completion of the Traffic Control Supervisor training course offered by the American Traffic Safety Services Association or equivalent current certification as determined by the Engineer.

.3 Equivalent training courses and certifications may be those provided by, or in affiliation with, the following:

.1 American Traffic Safety Services Association (ATSSA)
.2 Provincial government agency or construction safety association
.3 Government of Canada
.4 State government agency or construction safety association (U.S.).
.5 Courses provided by other agencies may require some additional training to be attained, depending on course curriculum.

.4 Prior to commencing traffic control operations, provide evidence acceptable to the Engineer that required personnel are certified as described in this section.

.5 If the Engineer determines that the performance of Traffic Control Persons, the Traffic Control Supervisor, or any other persons responsible for traffic control, is unsatisfactory in terms of traffic safety, regardless of whether such persons possess valid certification, the Contractor shall forthwith ensure satisfactory performance, or replace such persons with satisfactory personnel if so directed by the Engineer. The Engineer's remedy in this clause is in addition to any other remedies specified in the Contract documents.

.6 The provision of training and certification will be considered incidental to other Traffic Control bid items, and no separate payment will be made.

.3 At all times, perform the work in a manner that will create the least interference with traffic, consistent with the performance of the work.

.4 Do not park construction equipment, when not working, less than 10 m away from the outside edge of the traveled roadway of any publicly used road, unless approved otherwise by the Engineer.

.5 Do not park construction equipment and vehicles, including employee vehicles, in such a manner as to obscure, or in any way block, the road users' view of traffic control devices.

.6 Keep the traveled way free of foreign objects such as spilled earth, rock, timber and other items that may fall from transporting vehicles. Immediately remove materials spilled or dropped along or across any public traveled way, both within and outside the contract limits.

.7 Ensure that Traffic Control Persons and pilot vehicle operations are not positioned or operated in a manner that obstructs traffic from accessing commercial facilities or roadside attractions.

.8 Provide and maintain reasonable access to property fronting or in the vicinity of the work. Make adequate arrangements with the affected property owners where temporary disruption of their access is authorized by the Engineer. No separate payment will be made for this work.

.9 Keep equipment units as close together as working conditions will permit and preferably on same side of traveled way.

.10 Do not close the highway, any lane of the highway, or reduce any lane width unless specified in the Contract documents, or approved by the Engineer. Before re-routing traffic, install suitable signs and devices in accordance with the traffic control plan, typical layout drawings contained within the contract documents, and within guidelines contained in the Manual of Uniform Traffic Control Devices for Canada.

.1 Unless specified otherwise, provide 7.5 m wide roadway exclusively for traffic in two-way sections through the work and on detours.

.2 Unless specified otherwise, provide 5 m wide roadway exclusively for traffic in one-way sections through the work and on detours.

.11 Maintain all roads so that dust does not create a safety hazard to the traveling public. No direct payment will be made for carrying out the necessary dust control operations as the cost will be considered as being included in the contract bid items for the appropriate material item.

00B.5.2 Equipment

.1 Maintain equipment at an acceptable level of safety. Maintain equipment lighting at an acceptable level of safety for both the traveling public and operators during night operations.

.2 Install equipment warning lights on construction equipment and vehicles required to work or stop on the roadway, including service vehicles. Trucks hauling aggregate and heavy equipment associated with the road construction are exempted from this requirement when the work zone is controlled by Traffic Control Persons. Mount warning lights on the vehicle roof or in an elevated position so as to be visible to traffic and operate the lights when the construction equipment or vehicle is in use.

00B.5.3 Maintenance of Travel Surface

Ensure that the travel surface throughout the construction zone, including diversions and detours is maintained in a condition which is considered to be safe and suitable for public traffic by the Engineer. No direct payment will be made for carrying out the necessary maintenance operations as the cost will be considered as being included in the contract bid items for the appropriate material item.

00B.5.4 Placement of Traffic Control Devices

.1 Install non-portable signs and other fixed traffic control devices prior to commencing work.

.2 Position portable signs and other temporary traffic control devices prior to commencing work in each work area, and move and maintain devices as the work progresses.

.3 Position portable signs and other temporary traffic control devices at each hazardous area, and do not remove them until the hazard has been eliminated.

.4 Remove all construction signs immediately after the project is completed.

.5 Avoid redundant, inappropriate, or unwarranted signs to prevent confusion. Immediately cover or remove signs which are not in effect.

00B.5.5 Traffic Control Level I

.1 Supply, install, and maintain adequate traffic control devices.

.2 Supply all traffic control devices in conformity with the Manual of Uniform Traffic Control Devices for Canada, or as shown in the drawings included in the contract documents, or as approved by the Engineer. All signs, delineators, barricades shall conform to the required standards, in shape, colour and size.

.3 Install all non-portable signs conspicuously, and face them at right angles to the roadway with the bottom of the sign at a height of 1.5 m above the road, and not less than 2 m or more than 4 m from the nearest traffic lane. Portable type signs, mounted on approved weighted stands, may be used where signs must be moved often.

.4 Mount portable signs to a minimum clearance of 300 mm from the road surface to the bottom of the sign.

.5 All construction signs, barricades, and delineation devices shall be retroreflective as per the Manual of Uniform Traffic Control Devices for Canada.

.6 Check the devices daily for legibility, damage, suitability and location. Clean, repair or replace the devices to ensure clarity and reflectance.

.7 Oversize signs may be used where conditions require greater visibility in order to be effective. Use these signs in special circumstances where more than average attention value is required from the sign.

.8 Use construction markers to mark hazardous drop-offs, windrows, excavations, or any obstruction that impedes traffic flow. Mount construction markers on suitable supports 600 mm between the ground level and the bottom of the marker. Supplement construction markers with signs and barricades. Use enough construction markers to adequately delineate the hazard and space them no further than 50 m on tangent and 25 m on curves. Reduce spacing of devices if required to safely delineate the hazard.

.9 Drums, when approved by the Engineer, may be used in special cases for maintaining a lane closure or for separating opposing lanes of traffic.

.10 Cones, when approved by the Engineer, may be used for temporary hazardous conditions on a daytime only basis.

.11 Install "Stop" signs on all subsidiary roads intersecting a Detour Route.

.12 Post speed limit signs every 750 m throughout the work area where speed zones are required. Signs shall indicate limits in accordance with the traffic control plan, typical layout drawings contained within the contract documents, or as directed by the Engineer.

.13 Remove or cover signs which do not apply to conditions existing from day to day.

.14 Maintain an extra stock of devices on site to replace those lost or damaged.

.15 Supply equipment warning lights in conformance with Paragraph 1.3.9.

.16 Supply buffer vehicles as specified, or as directed by the Engineer.

.17 Do not install traffic signals without the approval of the Engineer. When the use of traffic signals is approved, supply and install all necessary equipment. Turn off traffic signals when not in use.

00B.5.6 Traffic Control Level II

.1 Supply Traffic Control Persons for each work area on a continuous basis, regardless of traffic volumes. Traffic Control Persons shall be required:

.1 When public traffic is required to pass working vehicles or equipment which may block all or part of traveled roadway, except for work designated by the Engineer as an exclusively mobile type operation

.2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use

.3 When personnel or equipment are employed on traveled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning
.4 Where temporary protection is required while other traffic control devices are being installed or taken down
.5 For emergency protection when other traffic control devices are not readily available
.6 In situations where complete protection for personnel, working equipment and public traffic is not provided by other control devices
.7 Any other instance where the Engineer determines that Traffic Control Persons are necessary to ensure safe working and traveling conditions within the work zone limits

.2 Adequately instruct Traffic Control Persons in the proper traffic procedures for the work.

.3 Ensure that Traffic Control Persons are neatly dressed in high visibility hard hats and high visibility apparel in conformance with current Yukon Occupational Health and Safety regulations.

.4 Equip Traffic Control Persons with standard traffic control paddles. For controlling traffic during the hours of darkness, also equip Traffic Control Persons with a red signal hand-light of sufficient brightness to be clearly visible to traffic.

.5 Equip Traffic Control Persons with 2-way radios to enable communication when they are not clearly visible to one another.

.6 Provide substitute Traffic Control Persons at meal times and when necessary to give the regular Traffic Control Person a break.

.7 Provide proper signs and sign spacing for Traffic Control Persons in accordance with the traffic control plan, typical layout drawings contained within the contract documents, or as directed by the Engineer. Move signs as required to follow the work.

.8 Provide Traffic Control Person floodlights during the hours of darkness.

.9 Do not delay public traffic more than 15 minutes for Contractor operations.

00B.5.7 Traffic Control Level III

.1 Provide pilot vehicle service in accordance with the traffic control plan, or as directed by the Engineer, and provide additional traffic control devices as required.

.2 Supply pilot vehicles suitable for supporting the required signs.

.3 Mount pilot vehicle signs, approved by the Engineer, above the roof of the vehicle at least two metres above the ground, clearly visible to road users from

both the front and the back. Illuminate the signs during hours of darkness. Cover the signs or render them invisible to sight of the traveling public when not in use.

.4 Mount at least one equipment warning light so that it is clearly visible from all directions. Operate the light at all times the vehicle is on duty.

.5 Operate the pilot vehicles in conjunction with two Traffic Control Persons, one stationed at each end of the piloted area.

.6 Equip pilot vehicles with a 2-way radio system for the purpose of communicating with the Traffic Control Persons.

.7 Pilot vehicles will be required in the following situations, at the discretion of the Engineer:

.1 Where public traffic must share the roadway with heavy construction equipment, such as rock trucks, scrapers, loaders, etc.,
.2 Where public traffic must use particularly hazardous routes,
.3 Where public traffic is required to remain in one lane or change periodically from one lane to another,
.4 When it is necessary for public traffic to negotiate sections of construction at restricted speed,
.5 During poor visibility conditions, and
.6 When the route through construction is not clearly evident to public traffic.

.8 Provide additional traffic control devices as required.

.9 Provide a sufficient number of pilot vehicles to limit delay to public traffic to a maximum of 15 minutes.

00B.5.8 Traffic Control Supervisor - Level IV

.1 Provide a Traffic Control Supervisor.

.2 The Traffic Control Supervisor must be a competent person, trained and certified in traffic control procedures, and responsible for supervising all aspects of the Contractor's traffic control. Do not assign duties other than traffic control to the Traffic Control Supervisor. The Traffic Control Supervisor's duties must be traffic related only, and include, but are not necessarily limited to the following:

.1 Providing instruction and additional training to Traffic Control Persons as required
.2 Organizing and supervising the operations, movement, and relief of Traffic Control Persons
.3 Ensuring that Traffic Control Persons are properly informed with regard to road conditions, located in an appropriate and safe location, and are relaying the proper information

.4 Installing and positioning traffic control devices, and moving or removing them as conditions change
.5 Maintaining traffic control devices and ensuring that their reflective surfaces are clean
.6 Planning traffic control with the Engineer
.7 Discussing the daily work plan with Engineer and Contractor's superintendent
.8 Maintaining accurate daily records which indicate the location of all traffic control devices in use, time of inspection, maintenance action taken, and supplying copies of these records to the Engineer on a daily basis
.9 Liaising with roadside facilities to ensure traffic control does not unduly hamper access to facilities, and acting as the contact person for all traffic related complaints or inquiries
.10 Ensuring that Traffic Control Persons are conveying to road users how they may access commercial and public facilities within the work zone.
.11 Ensuring traffic control meets requirements of Section 02010, Traffic Control, and standard drawings provided in the contract documents

.3 When the equipment is shut down, the Traffic Control Supervisor must periodically patrol the work to ensure that traffic control devices are properly positioned, in good condition and that the roadway is in a safe condition for road users.

.4 The Traffic Control Supervisor must immediately correct any unsafe condition, or immediately make arrangements to correct any unsafe condition that requires repair or work by others.

.5 Register the name and phone number of the Traffic Control Supervisor with the local police force to enable contact in the event of an emergency situation.

.6 Have on site at least one vehicle containing a complete set of extra signs, wooden posts, a posthole auger and other necessary tools and supplies to enable the Traffic Control Supervisor to carry out these duties.

.7 Provide mobile communication between the Traffic Control Supervisor's vehicle and a station or vehicle designated by the Engineer.

00B.5.9 Enforcement

.1 The Contractor is responsible for providing for the safe passage and control of traffic within the limits of the project.

.2 If the Contractor fails to provide for the safe passage and control of traffic, or fails to correct forthwith an unsatisfactory condition upon being directed by the Engineer, the Engineer may:

.1 At the Contractor's expense, correct the unsatisfactory condition and take such other action as deemed necessary, or
.2 Suspend the work until satisfied that the unsatisfactory condition has

been rectified and is safe for the road user. No considerations will be made for construction delay or increased costs due to such suspension.

.3 The Contractor will not be relieved from any responsibility because of any act, or failure to act, on the part of the Engineer.

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3.1 SCOPE

The work described in this section pertains to the supply and installation of culverts.

3.2 MATERIALS

3.2.1 CULVERTS

All culverts shall be a minimum diameter of 400 mm, 16 minimum gauge (1.63 mm) galvanised spiral corrugated steel culvert pipe (CSP-Helical) in accordance with CSA CAN 3-G401-M-81 Specification No. 501-M. The Engineer reserves the right to inspect and test the pipe after its delivery to the worksite, and if defects are found which make it unserviceable, the pipe may be rejected on the project.

3.2.2 BEDDING AND BACKFILL MATERIALS

The Engineer shall approve the type of granular material used for compacted bedding for culverts. It shall be free from rocks larger than 20 mm in size. It should not contain any frozen material, sod, cinders, or organic matter. Culverts shall be backfilled with selected native materials free of rocks and cobbles greater than 80 mm in size.

3.2.3 ROCK RIP-RAP

Stones for rock riprap shall consist of fieldstones or rough unhewn quarry stone as near rectangular as practicable. Broad flat stones shall be preferred to rounded or cubic stones. Stones for rock riprap shall consist of the following:

- Smaller than 450 mm or 130 kg 100%
- Larger than 350 mm or 70 kg 20%
- Larger than 300 mm or 40 kg 50%
- Larger than 250 mm or 10 kg 75%

~~3.2.4 BAGGED CONCRETE RIP-RAP~~

~~Bagged concrete riprap shall consist of burlap bags, of approximately 0.03 m^3 capacity, filled to approximately 70% full with freshly mixed low slump, 25 MPa concrete. The bags shall then be folded over and firmly closed.~~

3.2.5 GEOTEXTILES

Non-woven Polypropylene, min 1.7 mm thickness in accordance with CAN / CGSB-148.1-M85, opening size 100 micrometers with a tensile strength of 700 N.

3.3 INSTALLATION

3.3.1 TRENCHES

Where the foundation for a culvert is below the natural ground, a trench shall be excavated in which to form the bed and place the culvert in accordance with the construction drawings.

The bedding surface for pipe culverts shall provide a firm foundation of uniform density throughout the entire length of the culvert and shall be slightly cambered in the direction parallel to the pipe centreline in order to correct for expected settlement and ensure tight joints in the lower half of the pipe.

3.3.2 CONTROL OF WATER

If a culvert is installed in a watercourse then appropriate permits must be obtained. Some culverts may require a permit from the Water Board. The Contractor shall provide for the uninterrupted flow of existing watercourses during culvert installation, including temporary channel redirection and pumping if necessary. The Contractor shall remove any water accumulated in the excavation by pumping or other means approved by the Engineer.

3.3.3 BEDDING

The culverts shall be bedded in a compacted granular foundation to 95% Standard Proctor Density, carefully shaped, as shown on the construction drawings, and set to the desired grade. Geotextile should be used to improve foundation support if required.

All unsuitable materials encountered shall be removed below grade and replaced with suitable granular material in such a manner as to provide a compacted cushion having a thickness of not less than 150 mm.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, all of such unstable soil under the culvert shall be removed and replaced with granular material properly compacted to provide adequate support for the culverts, as detailed on the construction drawings.

3.3.4 INSTALLATION OF CORRUGATED STEEL CULVERTS

The pipe shall be laid in the lengths and locations shown on the drawings, with the separate sections joined firmly and with coupling bands as specified by the manufacturer. Any metal in the joint, which is not protected thoroughly by galvanizing, shall be coated with a suitable asphaltic or approved rust preventative paint. For extension to existing culverts, the Contractor shall be responsible for preparing the existing end of the culvert to ensure a proper joint.

The installation of grates on the end of a culvert is allowed if deemed necessary by the Engineer. Grates shall be rotated so bars are located horizontally.

Proper facilities shall be provided for lowering the pipe in the trench. The pipe shall be laid carefully and set to lines and grades as given, minimum grade 1.0%. Any pipe, which is not in true alignment after being laid, shall be taken up and re-laid. All damaged pipe shall be replaced, or repaired if approved by the Engineer. Any such repair shall be re painted with an approved asphaltic or rust preventative paint.

3.3.5 BACKFILL

Culverts shall be backfilled with selected native materials free of rocks and cobbles greater than 75 mm in size. Backfill surrounding the pipe shall be placed in maximum 150 mm lifts and carefully compacted to 98% of Standard Proctor Density at optimum moisture content, using a hand tamper if necessary, to a level indicated on the construction drawings.

3.3.6 ROCK RIP-RAP

Rock riprap shall be placed on the surface to be covered as shown on the construction drawings or as directed by the Engineer, on a slope not exceeding 1.5 : 1, starting with the larger stones on the bottom row. Each stone shall be hand placed with the broad flat surface resting on a horizontal earth bed prepared in such a way that the earth and not the underlying stone carry the weight of the stone. Stones shall be laid in successive rows, or layers, proceeding upwards, with the joints staggering those of the adjacent rows to secure a shingled effect, evenly stepped. Voids between stones shall be filled with smaller stones conforming to Section 3.2.3, rammed into place.

~~3.3.7 BAGGED CONCRETE RIP-RAP~~

~~Where bagged concrete riprap is to be used, it shall immediately be placed on the area to be riprapped in a manner conforming to Section 3.3.6 to form a shingled effect, evenly stepped with joints staggered. The bagged concrete riprap shall, when laid, be flattened and tamped into close contact and care shall be taken to eliminate any dirt and debris between bags. The surface so formed shall have an average thickness of not less than 150 mm. The bagged concrete riprap shall be kept moist for a period of not less than 24 hours. No placement of bagged concrete rip rap shall be permitted during temperatures colder than 1 degree Celsius without the approval of the Engineer, and adequate precautions shall be taken for the protection or heating of the concrete~~.

SECTION 4 - TRENCHING AND BACKFILLING

Table of Contents

4.1 Scope

The work described in this section pertains to trenching and backfilling in conjunction with water and sewer installations.

4.2 Definitions

Where soils are referred to in these specifications, they shall be as defined in the "*Guide to the Field Description of Soils for Engineering Purposes*", Technical Memorandum 37, published by the National Research Council.

Sand and gravel shall be approved by the Engineer before being used and must conform to the City of Whitehorse Servicing Standards Manual.

4.2.1 Sand

Particles conforming to Technical Memorandum 37, smaller than the 5.000 mm sieve but larger than the 0.080 mm sieve shall be classified as sand.

4.2.2 Gravel

Particles conforming to Technical Memorandum 37, smaller than 75 mm in diameter but larger than the 4.750 mm sieve shall be classified as gravel.

4.2.3 Common Excavation

The excavation of all deleterious materials including hardpan, quick sand, frozen earth, and rock, concrete or masonry less than 0.75 cubic metres in volume, shall be classified as common excavation.

4.2.4 Rock Excavation

The excavation of rock, concrete or masonry exceeding 0.75 cubic metres in volume; and solid ledge rock, concrete or masonry which requires for its removal drilling, blasting, wedging, sledging, barring or breaking with a power-operated hand tool, shall be classified as rock excavation.

Soft or disintegrated rock, concrete or masonry which can be removed with a hand pick, power operated excavator or shovel; and loose, shaken or previously blasted rock will not be classified as rock excavation.

Frozen material is not classified as rock.

4.2.5 Frost Susceptible Soils

Soil in which significant ice segregation (the growth of ice in lenses, layers, or veins in soil) will occur resulting in frost heave or heaving pressures when requisite moisture and freezing conditions exist.

4.2.6 Unsuitable Backfill Material

Boulders or rocks larger than 200 mm in diameter, ice, snow, organic material or debris shall not be permitted in backfill. Soils with over optimum moisture content are not consider unsuitable. Contractor shall be responsible for moisture conditioning as required to meet Contract requirements.

4.3 Excavation

4.3.1 Grade and Alignment

The trench shall be excavated to the depth shown on the drawings for the class and type of pipe specified, so that the pipe can be laid to the line and grade shown on the drawings, or as established by the Engineer.

4.3.2 Trench Width

The minimum trench width shall be measured 300 mm above the crown of the pipe and shall be as per the standard drawings. Where the maximum trench width is exceeded without authorization of the Engineer, the Contractor shall be responsible for providing a higher class bedding, or a stronger class pipe, or take other precautions as may be directed by the Engineer.

4.3.3 Uniformity

The subgrade shall provide a uniform and continuous support for the pipe and fittings on solid, undisturbed ground. Any over-excavation by the Contractor below the required grade shall be backfilled with an approved compacted material.

4.3.4 Dewatering/Snow Removal

The Contractor shall supply all the necessary equipment, materials and labour required to keep excavations and trenches free from both ground and surface water, snow, snow melt and ice, no matter what the source.

The trench shall have snow/ice removed or be drained of water as required in such a way that the workers may work safely and efficiently and in such a manner so as to prevent injury to public health, damage to private or public property, or the Work. All water encountered, regardless of the origin, shall be pumped, bailed out, or otherwise diverted away from the trench. Snow and/or ice shall be excavated out and removed from site. No payment will be made for over excavation or material replacement. In no case shall the pipe be used as a drain for such water. Discharge of the trench dewatering pumps shall be conducted away from the site of the work and into natural drainage channels, drains or storm sewers as approved by the Engineer.

The expense of removing water, snow and ice is the responsibility of the Contractor.

4.3.5 Rock

If, during excavation, material appearing to be rock is encountered, the Contractor shall notify the Engineer. The Contractor shall provide ample opportunity for the

Engineer to investigate the material and make such measurements as are necessary to determine the volume.

Rock encountered in the excavation area shall be shattered to a depth of 0.50 metres below the bottom of the trench and then shall be removed to a minimum depth of 0.20 metres.

Where rock or large stones are encountered in the trench, such material shall be removed to provide a clear distance between any part or projection of the rock and the outside wall of all pipe and fittings for a distance of not less than 150 mm for 600 mm diameter pipe or smaller, or a distance of 200 mm for pipe having an outside diameter greater than 600 mm. The subgrade of the trench shall then be backfilled with an approved granular material compacted in 200 mm compacted lifts to a minimum of 95% Standard Proctor Density.

Excavated rock shall not be used for backfill.

4.3.6 Open Trench

Trenches shall be excavated only so far in advance of pipe laying operations as safety and traffic conditions will allow, or as permitted by the Engineer.

All trenches shall be backfilled as the work proceeds and no more than 50 metres shall be left open at the end of each day's work for a maximum period of 24 hours, unless otherwise directed by the Engineer.

4.4 Unsuitable Pipe Foundation Material

The Contractor shall excavate material which is unable to properly support the pipe such as ashes, cinders, refuse or organic material. The Contractor shall excavate such material to the width, depth and length ordered by the Engineer, and dispose of the material as directed. The material shall then be replaced with an approved sand, gravel, or if necessary, bedding stone. The finished surface shall be shaped by hand tools to provide a uniform and continuous support for the pipe. Where proper support cannot be made by replacing unsound material with compacted sand, the Contractor shall utilize an approved bedding stone as directed by the Engineer.

Ensure the trench bottom can provide acceptable foundations prior to placement of pipe.

4.5 Excavated Material

All excavated material shall be stockpiled clear of the trench top and in such a way as to prevent material from falling back into the excavation in accordance with Yukon Occupational Health and Safety Regulations. The material shall be piled in such a manner that it will not endanger the work, obstruct other work, or hinder pedestrian or vehicle access to the rights-of-way. Sufficient clear space must be provided on one side of the trench to accommodate survey stakes.

Gutters and drainage channels shall not be obstructed nor otherwise block surface

drainage. Where this is impractical, satisfactory provisions shall be made for alternative drainage.

4.6 Trench Shoring or Bracing

Where necessary to control the width of open trench, or where specified on the drawings, use sliding prefabricated trench brace or cage, or provide shoring to minimize excavation.

Open-cut trenches shall be sheeted and cross-braced to protect the work and workers when required by the Yukon Occupational Health and Safety Regulations and by municipal ordinances.

Trench bracing, shoring, and sheeting are the responsibility of the Contractor, and shall be designed by a Professional Engineer registered in the Yukon.

4.6.1 Safety Requirements

When closed sheeting is required, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting. The Engineer reserves the right to order the sheeting driven to the full depth of the trench or to such additional depths as may be required for the protection of the work.

Excavate the trench and install sheeting in accordance with Yukon Occupational Health and Safety Regulations.

4.6.2 Removal of Shoring

Trench cross-bracing may be removed when backfilling has reached the level of such cross-bracing. Sheeting shall be removed as backfilling proceeds. Backfilling of holes left by sheeting below the trench bottom shall be carefully compacted, and thereafter backfilling and withdrawal of sheeting shall proceed together. No voids shall be left in the backfill by the withdrawal of the sheeting.

4.6.3 Shoring Left In Place

The Engineer may order shoring to be permanently left in place. Shoring that has been ordered left in place shall be cut off and removed to a depth of 900 mm below the existing or proposed final surface grades, whichever is the lower, or to an elevation designated by the Engineer.

4.7 Temporary Steel Plating in Roadways

Where excavations in roadways are to be left open for long periods of time, the Engineer may require the excavations to be covered with temporary structural steel plates. Such plates are the responsibility of the Contractor and shall be designed by a Professional Engineer registered in the Yukon. All steel plates shall be thoroughly anchored in place with asphalt cold mix, as required.

4.8 Blasting

Blasting for excavation will be permitted only with the approval of the Engineer and only when proper precautions are taken for the protection of persons or property. The Contractor's method of blasting shall conform to the Yukon Occupational Health and Safety Regulations. The Contractor will be responsible for public notification. Provide copies of comprehensive general liability insurance certificates clearly showing that the Contractor has the necessary coverage.

4.9 Backfilling and Compaction

The Contractor shall not proceed with backfilling until the Engineer has inspected and reviewed placement of bedding material and the pipe installation.

Bedding and initial backfilling within the pipe zone shall be as specified by the Engineer for the particular pipe installed as specified elsewhere in these specifications.

Sufficient cover shall be maintained when using compaction equipment in order to prevent damage to the pipe.

Unless otherwise specified, all trenches shall be backfilled using the excavated native material. Boulders or rocks larger than 200 mm in diameter, ice, snow, organic material or debris shall not be permitted in the trench. The top 1.7 m of backfill material beneath streets or sidewalks, shall consist of non-frost susceptible granular material as determined by a Geotechnical Engineer licensed to practice in the Yukon. Where native material does not meet these specifications, the Contractor will be directed to remove and replace the objectionable material with approved imported trench fill material, unless otherwise specified in writing by the Engineer.

All material placed at a depth greater than 1.7 m below the final surface elevation shall be compacted to a density not less than 95% Standard Proctor Dry Density at optimum moisture content in 200 mm compacted lifts.

All material placed as a depth of 1.7 m or less under the final surface elevation shall be compacted to a density not less than 98% Standard Proctor Dry Density at optimum moisture content in 200 mm compacted lifts.

Compact to the specified density around manholes, hydrants, and other structures using approved hand operated mechanical tampers, unless otherwise approved by the Engineer.

The Contractor shall be responsible for adequate compaction of the trenches and for the correction of settlement during the maintenance period.

All waste and surplus excavated material shall be hauled away or disposed at a site located by the Contractor and approved by the Engineer. In the event of deficiency or non-compliance of backfill material, the Contractor shall seek approval approved for replacement material prior to the Work.

4.10 Existing Utilities and Structures

The Contractor shall be responsible for location, protection, temporary removal and replacement of existing utilities or structures necessary for completion of the Work, and shall be responsible for repairs of any damages that may occur.

Such existing utilities may or may not be shown on the drawings. If shown on the drawings, they are shown for general information purposes. The information may not necessarily be complete, correct or current. The Contractor must determine the location of all utilities, and make all enquiries necessary to determine the existence and location of the utilities from the utility companies.

The Contractor shall be responsible for all costs due to delays caused by the existence of such utilities or structures.

Other structures or utilities which when encountered during the work require permanent relocation, such relocation shall be done by the utility company, or if agreed, by the Contractor. The responsibility for the permanent relocation of utilities shall be the Owner. The Contractor shall not be entitled to claim compensation for any delay due to such relocation.

If interruption of service provided by an existing utility is necessary, the planned shutdown shall be approved by the Owners of the utilities. Requests for shutdown shall be made by the Contractor in writing a minimum of 2 weeks in advance.

4.11 Testing

The frequency of field density and moisture content tests shall be a minimum of one test per 100 linear metres or less of trench per lift thickness placed.

Engineer or Owner may increase frequency of testing at their sole discretion based on performance and/or site conditions.

If a test indicates compaction or moisture content not in accordance with the Contract, then the area shall be recompacted and/or moisture conditioned at the Contractor’s expense. Cost for failed test shall be born by the Contractor.

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5.1 Scope

The work described in this section pertains to the installation of water main piping, appurtenances and connections to existing water mains.

5.2 Materials

All materials used shall be of the manufacture stated on the plans and the following specifications.

5.2.1 Bedding Stone

Bedding stone shall be used at all times.

The bedding stone shall be free from organic material and shall meet the following grading requirements:

Sieve Size (mm)	Passing by Mass (%)		
25.000		100	
20.000	70	-	100
12.500	55	-	100
10.000	30	-	80
5.000	0	-	40
2.000	0	-	10

5.2.2 Water Mains and Fittings

Pipe for the water main shall be ductile iron (DI).

Pipe shall conform to the following specifications:

	Material	Class
(1)	Ductile Iron	Pressure Class pipe, Minimum Class 350 for 400 mm dia or smaller ANSI/AWWA C150/A21.5

Pipe coating shall be asphaltic, ANSI/AWWA C151/A21.51

Rubber gasket joints for DI pressure pipe and fittings shall conform to AWWA C111.

Cement mortar lining for DI pressure pipe and fittings shall conform to AWWA C104.

Flanged DI pressure pipe shall conform to AWWA C115.

Fittings shall be suitable for 1035 kPa minimum operating pressure.

Non-flanged fittings 400 mm and greater shall be mechanical joint style.

Non-flanged fittings 350 mm and smaller shall be tyton joint style.

Flanged fittings shall be connected to plain end pipe with flange coupling adaptors. Flange coupling adaptor to be Dresser style 128, Robar 7404 or approved equal.

Thrust blocks shall be provided at all fittings, valves, bends, reducers, tees, caps and crosses. Where thrust blocks cannot be constructed, a suitable restraint mechanism shall be provided. Restrained length calculations shall be approved by Engineer.

Restraint for ductile iron pipe joints and fittings:

1. Uniflange Series 1450, 1400.
2. EBAA Series 1700, 1100, 2100.
3. Romac RFCA

Fittings shall be in accordance with AWWA C110 Specification for Ductile Iron, and shall be Terminal City Ironworks ACS Inc.

Fittings shall be enchased with polyethylene film in accordance with AWWA C105, latest edition thereof.

Pipe shall have Tyton™ joints conforming to AWWA specification C111, latest revision thereof. Pipe sizes are as shown on the construction drawings. Pipe shall be Canada Pipe, or an approved equal.

Tapping Sleeve shall be Robar Industries 6606 (corrosion protective).

(2) PVC

Type 1, Grade 1 to ASTM D1784 and C2837

ANSI/AWWA C900, CSA B137.3

235 psi, 1621 KPa, DR 18

Cell Class 1245B

Rubber gasket joints for PVC pressure pipe and fittings are to conform to ASTM D3139, latest revisions thereof.

Fittings are to be in accordance with AWWA Specification for Polyvinyl Chloride (PVC) Pressure Fittings for Water, AWWA C907 (latest revision).

Tapping sleeves are to be Robar, corrosion protective.

5.2.3 Insulation

Water main and service insulation to be rigid foam, factory-applied material specified as:

Material	Class
Density	35.2 kg/m^3 minimum ASTM D1622
Closed cell content	90% minimum ASTM D2856
Water absorption	4.0% by Volume ASTM D2842-69
Thermal conductivity	0.023 W/m @ 22 degrees Celsius, ASTM C518
Dimensional stability	3% ASTM D2126-B,E
Compressive strength	minimum 206 kPa @ 10% deflection ASTM D1261
Thickness	minimum 50 mm

Insulated mains shall have a jacket of high-density polyethylene carbon black, factory applied by continuous extrusion or approved tape-wrap method:

Sealant	butyl rubber
Tensile strength	21 MPa minimum
Thickness	1.14 mm minimum for extruded polyethylene or two (2) cross wraps, for a total minimum thickness of 1.27 mm for tape-wrapped polyethylene application

The pipe shall be located at the centre of the insulation material. An allowable tolerance on this specification is as follows:

(1) Total diameter of insulation pipe structure shall in no instance be less than the pipe diameter plus 100 mm.

(2) The minimum thickness of insulation at any location of the pipe shall be 50 mm.

The Engineer may check the thickness of the insulation in areas where the insulation appears to be deficient. The Contractor shall provide suitable tape and shall tape-wrap all locations where such tests are performed. Materials, which do not comply with the foregoing specification, will be rejected.

The Engineer shall reserve the right to have a representative present at the insulation applicator's plant during insulation application. The Contractor shall provide a schedule to the Engineer indicating when the insulation application will take place.

The pipe joints and fittings shall be insulated with a minimum 50 mm polyethylene half shell or where necessary, use approved field insulation kits. Protect insulation by applying polyethylene heat-shrink sleeves or a triple overlapping wrap of suitable heat-shrinking tape.

5.2.4 Valves and Valve Boxes

.1) Gate valves shall be a resilient seating valve and shall conform to the following:

- Cast iron body.

- Size as shown on the construction drawings.
- Flanged joints, bolts galvanized.
- 1200 kPa minimum operating pressure
- Bronze mounted solid wedge type gate complete with rubber resilient seating edge.
- Non-rising stem, 50 mm square operating nut.
- Opens counter-clockwise.
- In-line vertical position.
- O-ring stem seal.

The Contractor shall supply approved gate valves of the size and quantity specified on the construction drawings along with all records of tests as required under AWWA Specification C509, Section 6. Valves shall be installed in accordance with the standard drawings.

All valves shall be suitable for bury and use in cold potable water pipelines. Valves shall be installed in the vertical position.

Valves with flanges shall have flanged dimensions and drilling complying with ANSI B16.1 Class 125.

Restrained flange adapters shall be used to connect plain end pipe to flanged valves.
Valves which lead to caps shall be clearly tagged “Normally Closed”.

.2) Valve boxes shall have a 150 mm Nelson-type top section made of ductile iron. 150 mm riser section shall be asphaltic coated complete with: 25 mm mild steel extension stem, cast iron lid and a combination rock guard with 50 mm operating nut. Rock guard & operating nut to be set no closer than 300 mm below finished grade.

Valve boxes shall be of sufficient length to provide for adjustments of up to 300 mm in either direction. Valve box extensions shall be cast iron, suitable for use with the valve boxes to be installed.

5.2.5 Hydrants

In-line hydrants shall be Terminal City Iron Works ACS Inc. **Type C71P** or Clow (McAvity) Brigadier Series M, and must conform to AWWA Specification C502, and the following:

- Compression type shutoff
- 200 mm (8”) online chamber
- Depth of bury as indicated on construction drawings
- 2 hose nozzles, 63 mm inside diameter, 78 mm outside diameter with 7.5 higby-cut threads per 25 mm
- 1 pumper nozzle, 114 mm inside diameter, 146 mm outside diameter with 4” Stortz fitting
- Opens counter-clockwise
- 300 mm extension installed below hydrant flange
- Plugged drain outlet, unless otherwise specified

- Permanent bronze seat casing and O-ring seal
- Pentagon shaped operating nut – 38 mm point to flat
- Two coats of factory anti-rust, liquid plastic paint, marine yellow (6504) above ground, unless otherwise specified
- Insulated spacer and frost gaskets
- Extended body
- Breakaway flange (safety coupling) to be located above ground at the safety flange, not at the top of the hydrant barrel.

5.2.6 Concrete

All concrete for pipe cradles, thrust blocking at tees, bends, plugs, etc., as well as concrete backing around pipes, buttresses and anchors, where required for the construction of water mains, shall develop a compressive strength of not less than 20 MPa in 28 days. The maximum slump shall be 100 mm. Cement shall be Type 10, unless specified otherwise. Aggregates, proportioning, measurement, mixing, placing and finishing shall be in accordance with the applicable sections of CSA Standard CAN3-A.23.1. Concrete poured during temperatures lower than 5 degrees Celsius shall have a temperature not less than 5 degrees Celsius, and suitable means shall be provided to maintain this temperature for 72 hours. Concrete surfaces shall be moist-cured for not less than 24 hours.

5.2.7 Styrofoam Board Insulation

Styrofoam board insulation shall be extruded polystyrene meeting CGSB-41GP-14A TYPE 4 - Styrofoam min. HI-40: Min. Compressive strength 275 KPa to ASTM D1621; thermal resistive to ASTM C518-C177; Water absorption to ASTM D2842. Install insulation to size and location shown on the drawings.

5.2.8 Bollards

Bollards shall be installed in accordance with standard drawings, and where shown on drawings. Bollards shall be 150 mm Schedule 40 steel pipe, filled with 20 MPa concrete to provide a smooth rounded convex shape at the top.

Bollards to be painted above ground with 2 coats of yellow marine enamel. Pipe to be 2000 mm long, installed 1000 mm into the ground.

5.3 Installation

All buried nuts, bolts, transition couplings, restrainers and metal fittings to be coated with Denso Mastic and Denso Tape.

During completion of the Work, all pipe, fittings, valves and hydrants and other materials shall be unloaded, stockpiled and otherwise handled on site in a safe manner such as to prevent damage.

Inspect materials for any damages or defects prior to installation. Remove any damaged or rejected materials from the site.

5.3.1 Bedding and Backfill

All water pipes shall require Class B bedding, bedded on a 150 mm compacted layer in accordance with standard drawings and specifications. Bedding shall be continued up to the spring line of the pipe and for the full width of the trench. Following placement of pipe, and after thoroughly tamping and compacting the bedding around and underneath the pipe, the initial backfill consisting of bedding shall be placed in 150 mm layers from the spring line to 300 mm above the crown of the pipe for the full width of the trench.

Bedding shall be compacted to 95% Standard Proctor Density at optimum moisture content. Backfill above bedding and around appurtenances shall be compacted in accordance with Section 4.

Commence initial backfilling operations only after the Engineer has reviewed bedding and pipe installation.

Use drain rock for all wet ground conditions or as otherwise specified.

5.3.2 Laying

Bottom of trench shall be suitable for receiving bedding and pipe, as per Section 4 - Trenching and Backfilling. Lower approved pipe into trench so that the protective coatings & linings are not damaged. Ensure all pipe is cleaned inside and out of any foreign materials prior to connecting.

The pipe shall be laid true to the line, grade and depth, as shown on the drawings or as established by the Engineer, to prevent sags and humps and provide the proper bury at hydrants and valves. No deviations shall be made from the required line and grade without prior consent of the Engineer. Pipe having bell ends shall be laid with the bell ends facing the direction of laying. No pipe shall be laid in water or where the trench conditions are unsuitable. To enable proper joints to be made, bell or coupling holes shall be provided in the bedding. Ensure pipe haunches are properly and continuously bedded.

When pipe laying is not in progress, the open ends of pipes shall be protected to prevent foreign material and water from entering the pipe.

5.3.3 Joints

Pipe joints for shall be as follows:

(1) Ductile Iron & PVC - Bell and Spigot

The rubber gasket ring shall be inserted into the groove with the bell colour marking facing outward, in such a manner that it is seated evenly without twists. The ring shall not be lubricated. The bell, spigot and rubber gasket shall be wiped clean and dry immediately before assembly. The spigot end shall be lubricated with a film of approved NSF 61 soap lubricant, ensuring that the entire circumference is coated. It shall then be inserted into the bell and pushed in until

the reference mark on the spigot is flush with the end of the bell using approved equipment such that no damages occur to the bell. All joints shall be made in accordance with AWWA Specification C 111. The joints shall be lubricated and assembled in accordance with the recommendations of the manufacturer.

Pipe deflection at the joints, either vertically or horizontally, shall not exceed 3.3º for all pipe 75 mm to 300 mm and 2.0º for all pipe greater than 300 mm.

Where multiple deflected joints are used to form a curved alignment, either horizontally or vertically, the minimum allowable curve radius shall be 105 for all pipe 75 mm to 30 mm, and 176 m for all pipe greater than 300 mm.

5.3.4 Appurtenances

No valve, switch or other control on existing utility systems shall be operated for any purpose by the Contractor without prior approval of the Engineer.

The Contractor shall install all valves, fittings, hydrants, air release manholes, flushouts and other appurtenances at the locations shown on the construction drawings or as directed by the Engineer. Installation shall be in accordance with the standard drawings. Appurtenances which have movable parts shall be thoroughly examined and operated by the Contractor, who shall be satisfied before installation that they operate properly and are without visible defects.

Cut pipes where necessary to install appurtenances, in accordance with manufacturer's recommendation. Cut and bevel pipes squarely and accurately.

(1) Valves

Valves shall be installed at the locations shown on the construction drawings or as directed by the Engineer, in accordance with the standard drawings. Every valve shall be provided with an adjustable valve box. The valve box shall be plumb and centred over the operating nut of the valve, shall be set evenly on the valve bonnet, shall be supported so that it does not transmit shock or stress to the valve, and shall be braced against lateral movement to the sides of the trench. Valve boxes which are not plumb or centred over the valve nut shall be dug up and reset properly at the Contractor's expense. The casing shall be of sufficient length to accommodate the specified cover over the water main.

All hydrant valves and tees shall be flanged. The casing shall consist of a hood, 1 or more intermediate sections, and a top section with a lid and a suitable stone disc. The top section shall be flanged at its lower end and provided with a socket at the ground surface to receive a suitable cast iron lid.

Valves 450 mm and larger shall be installed horizontally with 75 mm schedule 40 steel bypass. Bypass to include 75 mm gate valve. Fabricated steel tapping saddles to be used for connections to main line pipe.

An extension stem of sufficient length to reach no closer than 300 mm of the final elevation of the top of the casing, when casing and extension stem are assembled

in place, shall be provided with each valve. The extension stem shall consist of a rod of mild steel having a minimum cross-sectional dimension of 25 mm and a bottom socket or bell of cast iron to fit a standard 50 mm x 50 mm valve operating nut.

Set top of valve boxes to final grades as noted in Section 10.0 - Adjustment of Appurtenances, or as directed by the Engineer.

(2) Hydrants

Hydrants shall be installed in-line, at the locations and elevations shown on the drawings, or to the elevations established by the Engineer and in accordance with the standard drawings. All hydrants shall be plumb with the steamer port perpendicular to the curb line and facing the street.

Hydrants shall have a 300 mm extension at the top as shown on the standard drawings. Hydrants which have 2 nozzles 90 degrees apart shall be set with each nozzle facing the street at an angle of 45 degrees. In-line hydrants shall be connected to the water-main by a tee, and a concrete pad shall be installed below the tee. Unless otherwise instructed in these specifications or directed by the Engineer, hydrant drains shall be plugged. Check operation of all hydrants in the presence of the Engineer.

5.3.5 Reactive Blocking

All plugs, caps, tees, crosses, reducers, hydrants, valves and bends deflecting 11¼ degrees or more shall be anchored to prevent movement. Suitable reaction blocking, as shown on the blocking standard drawing, or as directed by the Engineer, shall be used for this purpose. Blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe and on the ground in each instance shall be that which is shown on the drawings or as determined by the Engineer. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair. In the case of insulated pipe the insulation should be removed from the bearing area of the fitting to ensure a direct connection between the pipe and the concrete, and the area re-insulated with approved field insulation kits.

5.3.6 Connection to Existing Mains

The Contractor shall make all necessary connections to existing water mains and shall interrupt services to the existing system for as short a period of time as possible, completing all connections between the hours of 09:00 and 17:00 hours. Prior to making such a connection the Contractor shall make all necessary arrangements with the Engineer and notify those persons affected of the time and duration of the interruption. All connection shall be made in accordance with the drawings and specification.

5.4 Testing

Before acceptance of the work, the entire system shall be subjected to a hydrostatic pressure and leakage test in the presence of the Engineer, according to AWWA standard

C600 and City of Whitehorse standards. Contractor shall submit a written plan covering the testing and commissioning process. Testing shall only be undertaken when all services have been installed. The Contractor shall provide all necessary labour, materials and equipment for the test, including a suitable pump, measuring tank, pressure hoses, connections, plugs, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and leakage losses. The Contractor shall provide evidence that gauges used are accurate.

The system shall be filled slowly and air-bled at each hydrant. If there are sections that cannot be bled from hydrants due to the profile of the main, the Contractor will be required to tap the main at high points and install temporary bleeder valves. At the completion of testing, these taps shall be satisfactorily turned off or plugged at the main. Installation and abandonment of temporary bleeders shall be the Contractor's expense unless otherwise noted.

When the line has been filled and most of the air expelled, 24 hours shall be allowed for the remaining air and water to reach a constant temperature and absorbed by the pipe. The test section may be pressured through a hydrant, or a tap may be installed where necessary.

5.4.1 Pressure and Leakage Test

The DI and PVC water mains or sections of such water mains shall be subject to a pressure of 1.5 times the rated working pressure, or not less than 1035 kPa for a duration of not less than 2 hours.

Test sections shall extend hydrant to hydrant. Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Engineer.

Tests shall be made only after completion of services, partial or complete backfill, and a minimum of 24 hours after the pipe has been filled with water to allow for absorption into the mortar lining. No test shall be applied until at least 36 hours after the last concrete reaction or thrust block has been cast with high early strength cement.

The allowable leakage shall be determined as follows:

Ductile Iron and PVC Pipe Leakage Allowance
Allowable Leakage per 300 m of pipe per hour

Pressure	Pipe Diameter (mm)									
(kPa)	100	150	200	250	300	350	400	450	500	600
3100	2.42	3.60	4.81	6.02	7.23	8.44	9.65	10.86	12.04	14.46
2760	2.27	3.41	4.54	5.68	6.81	7.95	9.08	10.22	11.36	13.63
2410	2.12	3.18	4.24	5.30	6.40	7.46	8.52	9.58	10.64	12.76
2070	1.97	2.95	3.94	4.92	5.90	6.89	7.91	8.86	9.84	11.81
1900	1.89	2.84	3.79	4.69	5.64	6.59	7.53	8.48	9.42	11.32
1720	1.78	2.69	3.60	4.50	5.37	6.28	7.19	8.10	8.97	10.79

1550	1.70	2.57	3.41	4.28	5.11	5.98	6.81	7.68	8.52	10.22
1380	1.63	2.42	3.22	4.01	4.84	5.60	6.43	7.23	8.02	9.65
1210	1.51	2.23	3.03	3.75	4.50	5.26	6.02	6.78	7.49	9.01
1030	1.40	2.08	2.80	3.48	4.16	4.88	5.56	6.28	6.96	8.36
860	1.29	1.89	2.54	3.18	3.82	4.47	5.07	5.72	6.36	7.61
690	1.14	1.70	2.27	2.84	3.41	3.97	4.54	5.11	5.68	6.81

When, in the opinion of the Engineer, there may be possible damage to a newly constructed water main, no pressure and leakage test shall take place between October 1st and April 15th unless otherwise approved by Engineer and City of Whitehorse.

The number of joints is estimated from the total length of pipe installed, PLUS one joint allowance for each water service connection.

An additional allowance shall be made when testing against closed metal seated valves. This allowance is 0.0012 litres per hour for each millimetre of nominal valve size.

5.4.2 Valve Test

Each section between valves shall be brought to test pressure. Test pressure shall be held without loss for 2 minutes before opening the valve and releasing the pressure into the next section.

Check the operation of all valves in the presence of the Engineer. Unless otherwise directed mark all off-road valve locations with 50 mm x 100 mm pressure treated stakes, 0.9 m long, painted blue.

5.4.3 Existing Mains

Where connections are made to existing water mains, the pressure used to test sections of new water mains that cannot be isolated from the existing water mains shall be specified by the Engineer, or the leakage test may be waived by the Engineer. This shall not relieve the Contractor from the obligation to repair leaks or replace defective material.

5.5 Disinfection

Before being put into service, and before certification of completion by the Engineer, all installed mains shall be disinfected according to the AWWA Standard C-651 and City of Whitehorse Standards and tested and approved for bacterial content and residual chlorine. After 12 hours chlorine residual shall be 20 ppm.

If repairs are made to any section of pipe, disinfection shall be repeated

Contractor to prepare & operate valves, hydrants and/or temporary connections for the testing of chlorine residuals and bacteriological samples. Contractor shall **NOT** operate any boundary valves.

All tests will be taken by the Engineer with the assistance of the Contractor.

5.5.1 Flushing

The Contractor shall flush the water main with a minimum flow of 0.8 metres per second of water to ensure all foreign materials and contaminants are removed from the line. This practice shall be completed before disinfecting the water main. The table below summarizes the flow conditions required to achieve the specified 0.8 metres per second flow rate:

Pipe Diameter (mm)	Required Flow For 0.8 m/s Velocity (L/s)	Size of Tap (mm) Number of Taps 25	40	50	Number of 2.5" Hydrant Nozzles*
100	6.5	1	-	-	1
150	13.0	-	1	-	1
200	26.0	-	2	1	1
250	38.0	-	3	2	1
300	57.0	-	-	2	2
450	100.0	-	-	4	2

* With 280 kPa residual pressure, hydrants flowing to atmosphere will discharge 63 L/s from a 63 mm nozzle and 158 L/s from a 113 mm steamer nozzle.

5.6 Maintenance

If leaks develop in the Work before the expiry of the maintenance period, the Contractor shall make the necessary repairs. The leaks shall be deemed repaired when the leakage is less than that allowed in subsection 5.4.1 for leakage test.

5.7 Damages

Water introduced into the water mains shall be at the Contractor's risk. All damages to the pipe from freezing or other causes shall be repaired by the Contractor.

SECTION 7 - SEWER MAINS

Table of Contents

7.1 Scope

The work described in this section pertains to the supply and installation of sanitary and storm sewers.

7.2 Materials

7.2.1 Sanitary Sewer Mains

Pipe used for the sanitary sewer mains shall be either ductile iron (DI), or polyvinylchloride (PVC), and shall conform to the following:

	Material	Class
(1)	DI Pipe	Minimum Pressure Class 350 for 300 mm dia. pipe or smaller Minimum Pressure Class 250 for 350 mm to 500 mm dia. ANSI/AWWA C150/A21.5

Pipe to be Canada Pipe Company Ltd., or approved equal.

Pipe coating - asphaltic, ANSI/AWWA CI5 I/A21.51.

Rubber gasket joints and fittings - AWWA C111.

Cement mortar lining for pipe and fittings - AWWA C104.

Flanged DI pipe - AWWA C115.

Fittings - AWWA Specification for DI pipe, and shall be Terminal City Ironworks ACS Inc.

Pipe shall have Tyton™ joints conforming to AWWA specification C111, latest revision thereof. The mains shall be insulated where shown on the construction drawings. All pipe joints and fittings joints shall be bonded to provide electrical continuity across the joint. Bonding shall be provided using factory-installed copper strips or preformed copper lock wedges. All copper strips on wedges shall be coated with bituminous mastic coating. For insulated pipe use copper strips only, repair the insulation and apply a 300 mm Heat shrink tape over the insulation for the entire circumference of the pipe plus 75 mm.

	Material	Class
(2)	PVC	SDR 35

Pipe to have minimum pipe stiffness (F/Y) of 320 kPa at 5.0% deflection, ASTM D2412. Pipe to be manufactured to specifications for pipe size ranges as follows:
100 mm dia. – 375 mm dia. to ASTM D3034
450 mm dia. – 1200 mm dia. to ASTM F679

Pipe to include integral bell and spigot ends with stiffened wall section and formed groove for a rubber gasket. Joints to conform to ASTM D3212, gaskets to ASTM F477.

Pipe to be IPEX Company Ltd., or approved equal.

7.2.2 Insulation

Sanitary sewer mains, if insulated, shall be insulated using a rigid foam, factory-applied material specified as follows:

Density:	35.2 kg/m^3 minimum ASTM D1622
Closed cell content:	90% minimum ASTM D2856
Water absorption:	4.0% by Volume ASTM D2842-69
Thermal conductivity:	0.023 W/m @ 22 degrees Celsius ASTM C518
Dimensional stability:	3% ASTM D2126-B,E
Comprehensive strength:	minimum 206 kPa @ 10% deflection ASTM D1621
Thickness:	minimum 50 mm

Insulated mains shall have a jacket of high-density polyethylene carbon black, factory applied by continuous extrusion, or tape-wrap method, as follows:

Tape Jacket Material:	Polyethylene UV inhibited, formulated for superior cold weather properties (to -45°C)
Sealant:	Butyl rubber and resin
Tensile strength:	21 MPa minimum (ASTM D 1000) 8.93 Kg/cm width
Thickness:	1.14 mm minimum for extruded polyethylene or 2 cross wraps, for a total minimum thickness of 1.27 mm for tape-wrapped polyethylene application

The pipe shall be located at the centre of the insulation material. An allowable tolerance on this specification is as follows:

(1) Total diameter of insulation pipe structure shall in no instance be less than the pipe diameter plus 100 mm.

(2) The minimum thickness of insulation on any side of the pipe at any location shall be 50 mm.

The Engineer may check the thickness of the insulation, where thickness appears to be deficient. The Contractor shall provide suitable tape and shall tape-wrap all locations where such tests are performed. Materials which do not comply with the foregoing specification will be rejected.

The Engineer shall reserve the right to have a representative present at the insulation applicator's plant during insulation application. The Contractor shall provide a schedule to the Engineer indicating when the insulation application will take place.

The pipe joints and fittings shall be field insulated with a minimum 50 mm polyethylene

half shell, polyethylene heat-shrink sleeve or a triple overlapping wrap of suitable heat shrinking tape.

Remove insulation from around pipe where pipes are to connect to manholes or other structures. Mortar and seal pipe at manholes as specified herein. Re-insulate and protect any exposed pipe as necessary.

7.2.3 Storm Sewer Mains

Pipe used for the storm sewer mains shall be either reinforced or non-reinforced concrete pipe or CSP Ultra Flo pipe, and shall conform to the following section. Class and size of pipe as shown on the drawings:

	Material	Class
(1)	CSP Ultra Flo	CSPI No. 501-M

Ultra Flo pipe shall be spiral rib pipe c/w 19 mm x 19 mm external ribs; wall thickness of 2.0 mm; aluminized Type 2 steel. Minimum diameter of 450 mm. Joints to be H500 hugger band couplings c/w double "0" ring rubber gaskets and triple bolt, bar and strap.

7.2.4 Manholes

Manholes shall be reinforced concrete, manufactured as follows:

(1) Bases shall either be precast reinforced concrete (ASTM C478). Poured in place only at approval of Engineer.

Benching to be sulphate resistant, Type 50 cement.

(2) Barrels shall be minimum 1200 mm diameter, precast - ASTM C478.

(3) Tops shall be conical precast tops. Slab tops shall be constructed to ensure a minimum of 300 mm from the top of the slab to the bottom of asphalt or surface course gravel, or when depth to invert of manhole no less than 2.2 m.

(4) Where depth of the manhole from the lowest invert to the top of the frame exceeds 6.0 metres, safety platforms shall be provided and installed at mid-depth according to the manufacturer's recommendations and as shown on the standard drawings.

(5) Ladder rungs shall be galvanized, cast into barrels at maximum 400 mm spacing, with the first rung not to exceed 800 mm from finished grade.

(6) Manhole covers and frames shall be capable of withstanding AASHTO-H20 loading and either Norwood Foundry or Dobney Foundry of the Type as shown on the drawings. Use floating manhole frames for manholes located with paved roadways.

(7) Joints shall be confined “O” ring rubber gasket. All lifting holes to be plugged & finished inside smoothly with cement mortar.

(8) Cement mortar for pipe joints, manhole and catch basin construction shall be made of 1 part Portland cement, 1.5 parts clean, sharp sand, and clean water to provide workability.

(9) Frost covers shall be manufactured according to the standard drawings.

7.2.5 Catch Basins and Leads

Sewer pipe for catch basin leads shall be 300 mm ductile iron pipe as shown on construction drawings. Catch basin units shall conform to the standard drawings and shall be 600 mm in diameter and precast according to ASTM C478. The tops shall be flat and suitable for the specified frame and cover. Catch Basin cast-iron units shall conform to ASTM A48, Class 20. Catch basin frame and covers shall be either Norwood Foundry or Dobney Foundry of the type shown on the drawings. The joints shall be made using cement mortar, with bituminous mastic compound applied to the outside or rubber O-ring gasket. The sump shall be a minimum of 600 mm below the centre of the catch basin lead.

7.2.6 Safety Platforms

Supply safety platforms, as supplied by M.S.U. Daymond Ltd., or approved equal. Submit shop drawings for review and approval.

7.2.7 Bedding Sand

The bedding sand shall be free from organic material and shall meet the following grading requirements:

Sieve Size (mm)	Passing by Mass (%)
10.000	100
5.000	80 - 100
2.000	55 - 100
0.630	25 - 65
0.250	10 - 40
0.080	2 - 15

The liquid limit shall not exceed 25 and the plasticity index shall not exceed 6.

7.2.8 Bedding Stone

Bedding stone shall be used when wet trenching conditions exist.
The bedding stone shall be free from organic material and shall meet the following grading requirements:

Sieve Size (mm)	Passing by Mass (%)

25.000	100
20.000	70 - 100
12.500	55 - 100
10.000	30 - 80
5.000	0 - 40
2.000	0 - 10

7.3 Installation

During the course of the Work, all pipe, manholes, catch basins and other materials shall be unloaded, stockpiled and otherwise handled on site in a safe manner such as to prevent damage.

Inspect materials for any damages or defects prior to installation. Remove any damaged or rejected materials from the site.

7.3.1 Bedding and Backfill

Unless otherwise noted on drawings, all sewer pipes shall be placed on Class B Bedding, on a 150 mm layer which shall be continued up to the spring line of the pipe and for the full width of the trench. Following placement of pipe, and after thoroughly tamping and compacting the bedding around and underneath the pipe, the initial backfill shall be placed in 150 mm layers from the spring line of the pipe to 300 mm above the crown of the pipe for the full width of the trench.

Bedding shall be compacted to 95% Standard Proctor Density at optimum moisture content. Backfill above bedding, manholes, catch basins, and around appurtenances shall be compacted in accordance with Section 4.

Commence initial backfilling operations only after bedding and pipe installation has been reviewed by the Engineer.

Use bedding stone for all wet ground conditions.

7.3.2 Pipe Laying

Bottom of trench should be suitable for receiving bedding and pipe, as per Section 4. - Trenching and Backfilling. Lower pipe carefully into trench to prevent damage to pipe and material. Pipe and structures shall not be dropped into the trench. Ensure all pipe is cleaned inside and out of any foreign materials.

Each pipe shall be set to true to line, grade and depth as shown on the Engineer's drawings or established by Engineer. Pipe laying shall commence at the lowest point of the length being laid.

Pipe having bell ends shall be laid with the bell ends facing the direction of laying to form a smooth uniform invert, according to manufacturer's recommendations. Ensure pipe haunches are properly and continuously bedded.

When pipe laying not in progress, open ends of pipes shall be protected to prevent

foreign materials from entering.

7.3.3 Joints

All joints shall be made in strict accordance with the recommendations of the manufacturer and the specifications herein.

1. Ductile Iron/Polyvinylchloride Pipe

To enable proper joints, bell or coupling holes shall be provided in the bedding material.

Pipes shall be placed with the spigot ends pointing in the direction of flow. A ring tight connection shall be used to join bell and spigot. The ends of the pipe to be joined shall be wiped clean and dry immediately before assembly. Only the soap lubricant recommended by the manufacturer shall be applied to the ends of the pipe.

Install pipe in accordance with manufacturer's recommendations. Use approved materials and equipment to push pipes together. Use care not to dislodge rubber gaskets or damage ends of pipe. Pipe deflection at the joints, either vertically or horizontally, shall be made after joint is assembled, and not exceed one half the manufacturer's recommendations.

2. Corrugated Steel Pipe

The ends of the pipe shall be wiped clean before assembly. Place rubber O Rings around both ends of pipe being joined. Keep ends straight during assembly. Place hugger bands around pipe ensuring coupler corrugations seat snugly into the ribs of each pipe end. Tighten bolts until securely fastened in accordance with manufacturer's recommendations.

7.3.4 Appurtenances

The Contractor shall install all manholes, drop inlets, junctions, risers, catch basins and other appurtenances at the locations shown on the construction drawings or as directed by the Engineer. Installation shall be in accordance with the standard drawing.

Base for all structures shall be on solid, unfrozen ground free of snow and ice. Over-excavate the base if the material at bottom of trench is unsuitable for support, and replace with approved materials.

The following are standard requirements for manholes and catch basins:

(1) Manholes and catch basins shall be constructed of precast concrete sections complete as shown on the standard drawings. Set precast bottom sections plumb. Unless otherwise specified, set steps and openings as directed by Engineer or City of Whitehorse.

(2) All joints and junctions of sewer pipe connecting to manholes, catch basins and

curb inlets shall be carefully sealed with cement mortar and installed flush to the inside wall of the structures. The area around the pipe, the sewer main and the manhole shall be grouted to form a smooth finish.

(3) The channelled floor and benching shall be constructed according to the standard drawings forming smooth flow channels.

(4) Manhole and catch basin sections shall be joined using a rubber gasket or cement mortar. Where a rubber gasket joint is specified, the joint shall be made in accordance with manufacturer's recommendations. Where a cement mortar joint is specified, a layer of mortar shall be applied to the tongue of each section prior to lowering the precast section into place.

All joints on the inside of precast Sections of manholes shall be mortared and finished flush. All lifting holes shall be plugged with cement mortar and finished flush with the manhole wall. The mortar joints and holes shall be painted with a waterproof bituminous mastic on the outside of the joints.

(5) Manhole and catch basin frames and covers shall be set to the grade determined by the Engineer or as shown on the construction drawings. Refer to Section 10 - Adjustment.

(6) In freezing conditions, sand and cement shall be heated and the mortar mixture applied hot. The mortar shall be protected from freezing until mortar has set.

7.3.5 Concrete

Concrete used in benching manholes shall be Type 50. All other concrete for bedding, manholes, drop inlets, junctions, risers, catch basins and other appurtenances shall be Type 10, unless sulphate resistant, Type 50, is otherwise specified.

All concrete shall develop a compressive strength of not less than 20 MPa in 28 days. The maximum slump shall be 100 mm. Aggregate proportioning, measurement, mixing, placing and finishing shall be done in accordance with the current issue of CSA Standard CAN3-A.23.1. Concrete poured during temperatures lower than 5 degrees Celsius shall have a temperature not less than 5 degrees Celsius, and suitable means shall be provided to maintain this temperature for 72 hours. Concrete surfaces shall be moist-cured for not less than 24 hours. All forms for concrete shall be oiled, tight, rigid, strong and well-braced.

7.3.6 Connection to Existing Utilities

The Contractor shall break into existing manholes, catch basins or sewers as shown on the construction drawings. This work shall be performed to the proper Canadian Construction Standards and according to the dictates of good practice. Existing manhole floors shall be re-channelled and properly benched; the junction area shall be grouted to form a smooth joint.

Existing manhole channels shall be covered to prevent concrete & debris from entering the Sewer System. All debris, including concrete and excavated material,

shall be removed; and the vicinity of the connection shall be left in a tidy condition acceptable to the Engineer.

7.4 Testing

Upon completion of backfilling, sewer mains shall be tested in accordance with the equipments of this Section for alignment, obstructions, infiltration and exfiltration. If any section of the sewer main does not meet the requirements for alignment, obstructions, leakage and infiltration, the Contractor shall make such repairs and replacements as necessary until the deficient sewer main meets these requirements.

All tests shall be conducted after the service connections to the main have been installed (service connections include in-line tees/wyes, saddles, etc.).

7.4.1 Tolerances

The following tolerances on alignment, grade, joints and deflections shall be met before any sanitary or storm sewer is accepted by the Engineer:

(1) ALIGNMENT - The centre line of 900 mm pipe and smaller shall not be more than 150 mm off the given line. The centre line of pipe greater than 900 mm shall not be more than 50 mm per 300 mm of diameter off the given line. Where the pipeline alignment is straight between manholes, a line of sight must exist from manhole to manhole.

(2) GRADE - The invert of the sewer main shall not deviate from the given grade by an amount greater than 6 mm plus 20 mm per metre of diameter of sewer pipe.

(3) JOINTS - Deflections at pipe joints shall not exceed one half of the manufacturer's specifications.

(4) DEFLECTIONS - Deflections of polyethylene and PVC pipe shall not exceed those recommended by the manufacturer.

7.4.2 Visual Inspection

Manholes, mains and related appurtenances shall be visually inspected by the Engineer or the authorized inspector. If any work does not meet the requirements of the following specifications, the Contractor shall make such remedies as necessary to complete the work.

If by visual inspection it is determined that:

(1) service connections are not in accordance with the specifications;

(2) tolerances of sewer lines are not in accordance with the specifications;

(3) cracks of width greater than 0.25 mm longer than 300 mm;

(4) any non-reinforced concrete pipe, manholes; catch basins leads or sewer

appurtenances do not meet the specifications;

(5) other conditions exist that do not meet the specifications;

then these unsatisfactory conditions shall be remedied to the satisfaction of the Engineer.

7.4.3 Sewer Inspection by Television

All sewers shall be inspected by video camera after backfilling of the trench to finished grade prior to asphalt surfacing and again upon completion of asphalt surfacing. The inspection shall be made by employing television scanning equipment, which shall be provided by the Contractor. The Contractor shall employ a qualified closed-circuit television technician acceptable to the Engineer to carry out the inspection.

All television inspection shall be carried out in the presence of the Engineer, who shall be given at least 48 hours advance notice of any testing to be carried out. Television inspection shall be performed by the Contractor on all storm and sanitary sewers unless otherwise directed by the Engineer.

The television equipment shall consist of a self-contained camera and monitoring unit connected by cable. It must be waterproof and capable of lighting the entire pipe. Picture capabilities must be of a quality to show the entire pipe periphery. There must be the capability of providing measurement within the line to an accuracy of 0.33 m/km.

Picture quality must be such to produce a continuous 600-line resolution picture showing the entire periphery of the pipe. The following capabilities and items must also be available:

(1) direct voice communication;
(2) a camera towing service;
(3) self-contained electrical power;
(4) proper safety equipment to protect employees and the general public.

The camera's rate of progress shall be uniform during inspection and shall not exceed 6 m/min.

A television log shall be maintained during the inspection, showing location of leaks, faults, open joints, breaks, cracks, collapse, settlement, obstructions, infiltration or any other defects affecting the overall performance of the sewer line. The location of any defects shall be referenced from the manhole.

A separate log of service connections shall be kept with comments of condition and location in terms of distance from manholes.

Photographs shall be taken as directed by the Engineer or at the discretion of the television scanning operator. A minimum of one (1) photo per manhole reach is required plus one (1) of every deficiency.

Manhole identity number and location shall be noted clearly on all reports & tapes, as indicated on the drawings.

A final, typewritten, indexed report with corresponding photographs secured properly and referenced to the text, as well as copies of the actual camera footage on USB stick shall be submitted within 2 weeks of completion of inspection to the Engineer for his approval.

The Contractor shall review the submission prior to submission to the Engineer for accuracy and completeness.

The Contractor is responsible for cleaning and flushing all mains prior to televising sewers. All debris shall be collected at the outlet of the sewer and disposed properly. Ensure no foreign debris is flushed into the City's existing sewer system.

The Contractor shall be responsible for all works performed and for traffic control and any other related work incidental to the completion of television inspection.

The location of all deficient work will be recorded and photographed. The Contractor will be required to repair, re-install, restore or otherwise make good, to the satisfaction of the Engineer, any deficient work, including alignment problems, issues with inserta-tees, cracked or broken pipe, deformed pipe, leaks or any other faults not conforming with these specifications or those of the pipe manufacturer which the television inspection reveals.

After the deficiencies are repaired and corrected, but before Substantial Completion, the Engineer reserves the right to have the faulty areas re-inspected by the Contractor.

An indexed report and copies of the actual camera tape on approved media of the re-inspected faulty areas shall be forwarded to the Engineer prior to final acceptance of the sewer main.

7.4.4 Leakage Testing General

Leakage tests may be conducted on all sewers. The Engineer shall choose those sewers to be tested after construction is completed. Additionally, all sewers are to be tested that are below the ground water table or are anticipated to be at any time of the year.

7.4.5 Exfiltration Test

The maximum allowable exfiltration between manholes shall be 1.0 litres per hour per 10 mm of pipe diameter per 100 metres of pipe length. Duration of test shall be 2 hours.

Isolate the section to be tested by temporarily plugging the inlets of two manholes on either side of the test section. Fill the pipe, and manhole, with water to a depth of 1-2 m above crown of the pipe in the upstream manhole, or 1-2 m above elevation of ground water. (Do not exceed 3 m of head in downstream manhole). Allow 24 hours

for absorption of water & escape of air from the section before starting the test. Actual exfiltration shall be determined by measuring the change in elevation of the water at the manhole.

7.4.6 Infiltration Tests

Isolate the upstream end of the section to be tested. Place a 'v' notch weir, or approved measuring device in pipe at the lower end. Duration of test shall be 2 hours. The actual infiltration shall be the average of at least 8 readings taken at even intervals during the test. The maximum allowable infiltration shall be 1.0 litre per hour per 10 mm of pipe diameter per 100 metres of pipe length.

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8.1 Scope

The work described in this section pertains to the supply and installation of factory insulated water service piping and appurtenances.

8.2 Materials

8.2.1 Water Service

All services shall have supply and recirculation lines as shown on the contract drawings.

All services to new lots shall include one supply and one recirculation line installed as indicated on the contract drawings.

(1) Pipe

Service piping shall be HDPE DR 11 suitable for 1035 kPa minimum working pressure with factory-applied 50 mm insulation and waterproof jacket as described in Section 5 – Water Mains.

Residential supply services shall have a minimum internal diameter of 25 mm unless otherwise noted.

Residential recirculation services shall have a minimum internal diameter of 20 mm unless otherwise noted.

Commercial/industrial supply services shall have a minimum internal diameter of 50 mm unless otherwise noted.

Commercial/industrial recirculation services shall have a minimum internal diameter of 20 mm unless otherwise noted.

(2) Main/Curb Stops

Corporation main stops shall be Cambridge Bass or Mueller within HDPE inserts.

Pipe saddles to be installed by the Contractor shall be Robar 2706 double strap saddles, manufactured to the type of main being tapped.

Curb stops (CC's) shall be Cambridge Brass Model 203 Mueller H15219, stop & drain valves unless otherwise specified. All fittings shall be of the compressive type with HDPE inserts.

(3) Curb boxes

Curb boxes shall be Mueller A-726 for 20 or 25 mm services, or Mueller A-728 for 30 to 50 mm services, cast iron extension type with A-800 lids, or approved equal. Lengths shall suit installation and per standard detail. Stationary rods shall be provided. Rods shall not be field cut and welded.

(4) Grease

Future service connections shall be greased with NSF 61 non-toxic grease. Grease shall be applied from the CC 300 mm towards main.

(5) Pressure Reducing Valves

Pressure reducing control valves shall be Clayton CRD, Series 25AUB, all bronze body complete with pressure gauge, or approved equal.

8.2.2 Testing of Materials

The Engineer may at any time require the Contractor to produce certification by an independent testing authority that the materials currently used conform to the specified standards.

8.2.3 Bedding Sand

All services shall be laid on 150mm of granular bedding. The granular material shall be sand, free from organic material and shall meet the following grading requirements:

Sieve Size (mm)	Passing by Mass (%)
10.000	100
5.000	80 - 100
2.000	55 - 100
0.630	25 - 65
0.250	10 - 40
0.080	2 - 10

The liquid limit shall not exceed 25 and the plasticity index shall not exceed 6.

8.2.4 Bedding Stone

Bedding stone shall be used when wet trenching conditions exist.

The bedding stone shall be free from organic material and shall meet the following grading requirements:

Sieve Size (mm)	Passing by Mass (%)
25.000	100
20.000	70 - 100
12.500	55 - 100
10.000	30 - 80
5.000	0 - 40
2.000	0 - 10

8.3 Installation

Where possible, water service lines shall be laid in the same trench as the sewer service lines, 300mm to the right of the sanitary service when viewed towards the lot. The water service lines shall be installed in accordance with the standard drawings.

Lower approved pipe into trench, safely so that the materials are not damaged. Ensure pipe is cleaned of any foreign materials prior to joining.

8.3.1 Bedding and Backfill

Bottom of trench shall be suitable for receiving bedding and pipe, as per Section 4.0 - Trenching and Backfilling.

Bedding sand or stone shall be placed over the full width of the trench and compacted in 150 mm layers up to a level of 300 mm above the crown of the highest service in the trench. Bedding shall be compacted to the specified minimum density of 95% Standard Proctor Density at optimum moisture content. Backfill above bedding shall be compacted in accordance with Section 4.

8.3.2 Mainstops

The corporation main stop shall be threaded in by the tapping machine and installed in accordance with the standard drawing.

The minimum allowable distance from a main stop to an adjacent collar or coupling shall be 30 mm.

Where multiple connections to the water main are made, the tapping shall be spaced 600 mm apart and staggered around the upper half of the water main.

Corporation main stops shall be tapped and connected with approved service saddles into the upper half of the water main and inclined to the horizontal at an angle of 45 degrees.

Contractor shall provide the tapping coupon, for each tap completed, to the Engineer daily.

8.3.3 Double Union

No double union shall be utilized unless approved by the Engineer. In such a case, the double union shall be supplied and installed as per the manufacturer's specifications.

8.3.4 Elevation

The top of the water service at the property line shall be a minimum 2.4 m to 3.5 m below finished grade or as directed by Engineer.

8.3.5 Curb Stops and Service Boxes

Curb stops shall be installed at the centre of the lot unless otherwise shown on the drawings or where designated by the Engineer and installed so as to drain water from the building when in the shut-off position. The curb stop extension rod shall be adequately secured to the curb stop with a brass pin. The extension rod shall not be cut and welded to adjust length to suit. Contractor shall provide factor manufacture supplied curb stop extension rod to suit required depth and installation tolerances shown on standard detail.

The service box shall be set plumb and the upper section of the service box shall be adjusted to grade elevation. Installation shall be in accordance with the standard drawings.

8.3.6 Greased Services

Water services not connected to existing services shall be injected with approved non-toxic grease, in the presence of the Engineer. Prior to greasing, the Contractor shall open the curb stop to allow a full stream of water to escape and confirm that the line is not obstructed. Grease shall be injected through open CCs to a point 300 mm past the CC. Should the service be of such a length that a union is required to join the piping, the greasing shall extend to a point 300 mm past the union.

Upon completion of greasing the CCs will be closed. Greasing of the CCs shall be completed prior to the pressure testing the water system.

8.3.7 Marker Stakes

For services not connected to an existing structure, the Contractor shall place a 50 mm x 100 mm pressure treated wood marker stake, protruding 500 mm above ground. The stake shall extend down to the water service curb stop. The stake shall be painted blue.

8.3.8 Backfill

The backfill shall be placed and compacted in accordance with Section 4 - Trenching and Backfill. The backfill around the casing shall be compacted by mechanical tampers up to the finished grade so as to prevent tilting or movement of the installation.

8.4 Regulations

All building services installed shall conform to regulations governing plumbing and drainage issued by the Territorial authority having jurisdiction and municipal bylaws in effect at the time of the work.

8.5 Testing

The water services must be pressure tested as part of the watermain testing.

A continuity test shall be performed on the wire, ground, clamp and pipe in the

presence of the Engineer, and the Engineer shall witness the greasing of the services. A record of each test shall be recorded by the Contractor and witnessed by the Engineer.

8.6 Work and Damage to Private Property

Contractor shall obtain permission from Registered land owners to access private property, before removing any fences, trees, hedges, shrubs, private walks or other private property necessary to complete the Work. Obtain written agreement on the method of removal and replacement. Where necessary, the Contractor shall remove fences and re-erect them immediately after backfilling and cleaning up, but do not replace any fence material which is unsound. Where the Contractor believes the fence material is unsound, contact the Registered land owner and reach a written agreement as to the method of replacement.

Where trees, hedges and shrubs must be removed, such removal shall be done in an approved manner, removing only a sufficient amount to make space for the Contractor's excavating equipment. All trees, hedges and shrubs which have been dug up, and all surplus earth, shall be removed from the site of the work and disposed of as approved by the Engineer.

All damaged sidewalks, curbs, trees, hedges or shrubs shall be removed from private property, and within the roadway, and repaired at the Contractor's expense.

SECTION 9 - SEWER SERVICE CONNECTIONS

Table of Contents

9.1 Scope

The work described in this section pertains to the supply and installation of sewer service piping and appurtenances, including insulated sanitary sewer services where specified on the drawings.

9.2 Materials

9.2.1 Sewer Pipe

Pipe used for the sanitary sewer service connections shall be polyvinyl chloride (PVC) and shall conform to the requirements of this section:

	Material	Class
(1)	PVC	SDR 28 for 100 mm and 150 mm diameter Minimum pipe stiffness – 625 kPa

Manufactured to ASTM D3034 and certified to CSA B182.2.

Rubber gasket joints for PVC pipe and fittings to ASTM D3212, gaskets to ASTM F477.

Service connection greater than 150 mm diameter shall conform to applicable specification for sanitary sewer main.

(2) Fittings shall conform to the type of service pipe being installed.

(3) Sanitary services shall be connected to the sanitary main utilizing a saddle, wye or a tee approved by the pipe manufacturer. In addition, a long radius bend shall be used to connect the service pipe to the service saddle as per standard detail.

Sewer service saddles for connection to PVC and HDPE mains to be Robar 3626 stainless steel c/w mission clamp; pipe insert; gasket; and pipe stop tabs.

9.2.2 Insulation

Sanitary sewer service connections, where specified, shall be insulated with factory-applied 50 mm thick rigid foam and waterproof PE jacket as described in Section 7 - Sewer Mains.

Sanitary sewer riser pipes installed from the main to the long radius bends do not have to be insulated unless otherwise specified.

9.2.3 Testing of Material

The Engineer may at any time require the Contractor to produce certification by an independent testing authority that the materials currently used conform to the specified standards.

9.2.4 Bedding Sand

All services shall be laid on 150 mm of granular bedding. The granular material shall be sand, free from organic material, and shall meet the following grading requirements:

Sieve Size (mm)	Passing by Mass (%)
10.000	100
5.000	80 - 100
2.000	55 - 100
0.630	25 - 65
0.250	10 - 40
0.080	2 - 15

The liquid limit shall not exceed 25 and the plasticity index shall not exceed 6.

9.2.5 Bedding Stone

Bedding stone shall be used when wet trenching conditions exist.

The bedding stone shall be free from organic material and shall meet the following grading requirements:

Sieve Size (mm)	Passing by Mass (%)
25.000	100
20.000	70 - 100
12.500	55 - 100
10.000	30 - 80
5.000	0 - 40
2.000	0 - 10

9.3 Installation

Where possible, sewer services shall be laid in the same trench as the water service lines, 300 mm to the left of the water service when viewed towards the lot. The sewer services shall be installed in accordance with the standard drawings.

Lower approved pipe into trench, safely so that the materials are not damaged. Ensure pipe is cleaned of any foreign materials prior to joining.

9.3.1 Bedding and Backfill

Bottom of the trench shall be suitable for receiving the bedding and pipe, as per section 4.0 - Trenching and Backfilling.

Bedding sand or stone shall be placed over the full width of the trench and compacted in 150 mm layers up to a level of 300mm above the crown of the highest service in the trench. Bedding shall be compacted to a minimum of 95% Standard Proctor Density at optimum moisture content. Backfill above bedding and around appurtenances shall

be compacted in accordance with Section 4.

9.3.2 Sewer Main Connections

Service connections to all mains shall be by means of tee, wye or approved saddles with drilled hole and approved robar clamp for the pipe type being connected to. The connection shall be watertight. Service connections shall not protrude into the sewer main line. Service connections shall be made in accordance with the standard drawings.

Where multiple service connections are to be made to the sewer main, a centre of pipe to centre of pipe separation of 600 mm is required.

Where multiple service connections enter a manhole as is the case in a cul de sac, the services must tie to the manhole such that they enter at an angle equal to or greater than 90 degrees as measured from the direction of flow in the sewer main.

When tapping is required, the sewer main shall be tapped in the upper half. Care shall be taken while tapping to ensure that the sewer main is not fractured, and any broken pipe shall be removed from inside the sewer main. The tapping shall be only of sufficient size to permit the saddle to insert snugly into the hole. The saddle shall be manufactured using a stainless steel body with welded branch tube attached using double stainless steel straps. The branch tube shall be designed for installation of a 100 mm diameter polyethylene service pipe for residential services, unless specified otherwise on the drawings. In no case shall the building sewer pipe protrude into the sewer main.

Where directed by the Engineer, a riser shall be constructed.

9.3.3 Depth of Cover

The depth of cover on the sanitary service at property line shall be a minimum of 2.4 m and a maximum of 3.5 m above pipe obvert elevation or as directed by Engineer.

9.3.4 Grade

Minimum grade of the sanitary sewer services shall be two percent (2%).

9.3.5 Bends

Where horizontal bends are installed along sanitary service pipes, the maximum bend shall be 45 degrees using a long radius-type bend, or a combination of 22.5 degree bends and straight pipe.

9.3.6 Marker Stakes

The Contractor shall place a 50 mm x 100 mm wood marker stake, protruding 500 mm above the ground, located as shown on the standard drawings.

The stake shall be painted red and extend to the end of the service pipe invert.

9.3.7 Joints

Wherever possible, the HDPE pipe should be joined by the method of thermal butt-fusion, as outlined in ASTM-D3261, Heat Joining Polyethylene Pipe and Fittings. Butt-fusion joining of pipe and fittings shall be performed in accordance with the procedures recommended by the manufacturer.

DI or PVC pipe shall be joined in accordance with the Manufacturer's specification.

9.3.8 Backfill

The backfill shall be machine placed and shall contain no rock, stones, or boulders larger than 200 mm in their greatest dimensions. It shall be free from brush or any other perishable or objectionable matter, which would prevent proper consolidation or cause subsequent settlement.

After pipe installation and placement of bedding has been approved by the Engineer, the backfilling of the trench with approved materials shall be placed and compacted in accordance with Section 4.0 - Trenching and Backfilling.

9.4 Regulations

All building services installed shall conform to regulations governing plumbing and drainage issued by the authority having jurisdiction and municipal bylaws in effect at the time of the work.

9.5 Testing

Before final backfilling has started, the Contractor shall test the building sewer pipe for obstructions by rodding or snaking the entire length.

9.6 Work and Damage to Private Property

Contractor shall obtain permission from Registered land owners to access private property, before removing any fences, trees, hedges, shrubs, private walks or other private property necessary to complete the Work. Obtain written agreement on the method of removal and replacement. Where necessary, the Contractor shall remove fences and re-erect them immediately after backfilling and cleaning up, but do not replace any fence material which is unsound. Where the Contractor believes the fence material is unsound, contact the Registered land owner and reach a written agreement as to the method of replacement.

Where trees, hedges and shrubs must be removed, such removal shall be done in an approved manner, removing only a sufficient amount to make space for the Contractor's excavating equipment. All trees, hedges and shrubs which have been dug up, and all surplus earth, shall be removed from the site of the work and disposed of as approved by the Engineer. All damaged sidewalks, curbs, trees, hedges or shrubs shall be removed from private property, and within the roadway, and repaired at the Contractor's expense.

SECTION 10 - ADJUSTMENT OF APPURTENANCES

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SECTION 10 - ADJUSTMENT OF APPURTENANCES

10.1 Scope

The work described in this section pertains to the adjustments of all appurtenances.

10.2 Valve and Curb Boxes

Adjustments of valve box tops and curb box tops shall include the replacement of any broken boxes. The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be made so that the valves operate effectively. The rock guard and operating nut are to be located no closer than 300 mm below finished grade, and no more than 600 mm below the finished grade. Cutting and welding of operating stems is not permitted.

10.3 Manhole Frame Adjustments

Manhole frames shall be adjusted so that the top of the cover conforms exactly to the required elevation. All standard manhole frames shall be firmly set into position with cement.

Where it is necessary to raise manhole frames above the top ring it shall be done with approved pre-cast rings meeting the requirements of the current issue of ASTM C139 an a bedding of mortar. Under no circumstances shall the depth from the rim of the manhole to the first ladder rung be more than 800 mm. Pre-cast rings or courses of blocks shall be constructed in accordance with the construction drawings. A minimum of 300 mm of adjustment must be provided on all sewer appurtenances.

10.4 Manhole Reconstruction

Manholes may be reconstructed if the adjustment is beyond the limit specified in Section 10.3 using pre-cast barrels, which meet the requirements of the current issue of ASTM C478. Should any backfill be required around the manhole below the elevation of the base course surface, reconstruction shall meet the requirements of the construction drawings.

10.5 Catch Basin Adjustment

Catch basin frames shall be adjusted so that the cover inlet conforms to the required elevation and face of curb. All tops shall be set firmly into position with cement. Catch basin frame adjustments are to be done in a manner that provides a minimum of 250 mm clear, in the horizontal, for vertical access through the frame and rings to the pump.

10.6 Final Elevations

Tops of valve boxes, manholes, and catch basins shall conform to the design elevations. Generally, the following shall apply for setting the top elevations:

- Top in asphalt; 6 mm below the surface;
- Top in gravel; top 100 mm below surface;

- Top in landscaped area; top 50 mm above final grade with smooth transition to surrounding areas.

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11.1 Scope

The work described in this section pertains to the preparation and construction of the roadway, sidewalk and pathway subgrade and lot grading.

11.2 Subgrade

Subgrade for the roadway, sidewalk, pathway or lot shall be considered to be that material immediately beneath the imported material and the ditch grade line, as detailed on the construction drawings.

11.3 Borrow

Where sufficient quantity of suitable embankment material is not available from excavation, an approved borrow pit shall be established, by the Contractor as a source of imported fill.

11.4 Common Excavation

Common excavation shall consist of all materials such as earth, muskeg, clay, hardpan, shale, silt, sand, gravel, fractured bedrock, cobbles and frozen material, removed from the roadway. Excavation shall be to the lines and grades indicated on the plans.

11.5 Rock

Rock shall be defined as any material that cannot be removed without drilling and blasting, or boulders with a volume in excess of 0.75 cu.m. Material that can be ripped with an adequate ripping machine will not be considered rock. Also, cobbles and boulders less than 0.75 cu.m. encountered during excavation operations will not be considered rock.

11.6 Method of Construction in Excavation Areas

11.6.1 Scarify and Compact

In excavation areas, the top 200 mm of the subgrade shall be scarified and compacted to 98% Standard Proctor Density at optimum moisture content.

No stones or boulders larger than 100 mm in diameter shall be left within the top 200 mm of the roadbed subgrade unless otherwise directed and approved by the Engineer.

Do not place Granular Sub-base over subgrade areas until after proof rolling, grade and compaction testing.

11.6.2 Over Excavation

Materials, which cannot be compacted to the specified density due to a high or low moisture content, shall be dried or watered by the Contractor to their optimum moisture

content in order to achieve the specified compaction.

All common excavation materials below design subgrade elevation, which, in the opinion of the Engineer, are considered unsuitable, shall be removed and disposed of in an approved location.

11.6.3 Widening of Cuts

In the event the Contractor desires to excavate beyond the widths specified in the plans or as laid out by the Engineer in the field in order to provide material for use in embankments, he must first obtain the written approval of the Engineer or registered Land Owner.

11.6.4 Stockpiling of Material

To facilitate this operation, the Contractor may stockpile embankment material as approved by the Engineer. Such material shall be piled in such a manner that it will not endanger persons, the work, or adjacent properties. If the construction site does not facilitate stockpiling, the Contractor shall haul material to an approved location.

11.6.5 Rock Excavation

If during excavation, material appearing to be rock is encountered, the Contractor shall notify the Engineer.

Rock encountered in the excavation areas shall be shattered and removed to a point 500 mm below top subgrade and 200 mm below ditch bottom.

All common and rock excavation deemed unsuitable for use in embankments, or in excess of that required for embankment, shall be disposed of.

11.6.6 Excavation Waste

All disposal areas shall be left in a neat and tidy condition satisfactory to the Engineer. Excavation waste shall be bladed flat and smooth by the Contractor to blend in with the existing ground to the approval of the Engineer.

11.7 Method of Construction in Embankment Areas

11.7.1 Preparation of Embankment Foundation

Unsuitable material, as determined by the Engineer, underlying an embankment area shall be removed and disposed of in an approved dumpsite.

When an embankment is to be constructed on a slope or against an existing embankment, the entire existing surface on which the embankment is to be placed shall be scarified, benched or broken up in such a manner that the new material will bond with the resulting surface.

Embankment shall be constructed to the typical cross-section and grades shown on the plans and as set out by the Engineer, and shall include the formation, compaction and shaping of the embankment.

Sufficient crown shall be maintained at all times during construction to ensure ready run-off of surface water.

11.7.2 Embankment & Lot Fill

The suitability of the embankment material will be determined by its gradation and compactive qualities. Imported materials shall be reviewed and approved by the Engineer prior to use. The full depth of fills shall be constructed of suitable material in layers not exceeding 200 mm compactive depth. Each layer shall be compacted to 98% Standard Proctor Density at optimum moisture content.

Materials, which cannot be compacted to the specified density due to high or low moisture content, shall be dried or watered by the Contractor to their optimum moisture content in order to achieve the specified compaction.

In the top 200 mm of the subgrade, the maximum material size shall be 100 mm; below that, the maximum shall be 150 mm, unless otherwise authorized. All oversized material shall be removed and disposed of by the Contractor.

The use of frozen materials within an embankment section shall not be permitted. Any frozen materials found in an embankment section shall be removed by the Contractor. Frozen materials can however be thawed and if suitable, be used within the embankment.

11.8 Method of Construction General

11.8.1 Shaping and Finishing

The finished compacted subgrade shall be constructed to within 30 mm of the design section with final surfaces smooth, uniform, free of lumps, loose earth and debris. Localized soft spots that develop in the finished subgrade due to poor workmanship shall be corrected by excavating the material to a depth approved by the Engineer, and replacing it with suitable subgrade material compacted in place.

Maintain finished surfaces in condition conforming to this section until granular sub base is applied.

11.8.2 Cleanup

Existing and newly constructed drainage ditches, culverts and other utilities shall be cleaned out to remove any obstruction caused by the construction operation.

Loose rock and boulders larger than 150 mm and debris resulting from the Contractor's operations shall be removed and disposed of. Areas outside the actual roadway, but within the right-of-way, shall be graded to conform to the natural ground line.

11.8.3 Tests

Density testing:

The Consultant, in accordance with the following ASTM standards, shall carry out Field density and moisture content tests:

Standard Proctor Compaction Test	ASTM D698 Methods (A) and (B) or ASTM D1556
In-Place Density Test	ASTM D2167 or ASTM D2922 and D3017

The frequency of field density and moisture content tests shall be at minimum 1 test per 100 metres of constructed roadway, sidewalk, or pathway and at various locations left and right of centreline, or as directed by the Engineer. Lot grading shall be minimum 1 test per lift per 5 square meters.

Engineer or Owner may increase frequency of testing at their sole discretion based on performance and/or site conditions.

Before approval by the Engineer, the subgrade shall be true to grade and cross-section. The grade shall conform to the compaction requirements.

Proof rolling:

For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.

Obtain written approval from Engineer to use non-standard proof rolling equipment.

If use of non-standard proof rolling equipment is approved, Engineer to determine level of proof rolling.

Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire or as directed by Engineer.

Where proof rolling reveals areas of defective subgrade remove and replace as directed by Engineer.

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12.1 Scope

The work described in this section pertains to base course gravel for roadway, pathway and sidewalk construction.

12.2 Materials

12.2.1 Samples

Before any granular material is used in the work, the Contractor shall obtain and ship to an approved testing laboratory, representative samples containing not less than 25 kg. Sampling shall be done in accordance with the current issue of ASTM D75. The laboratory shall provide the Engineer and Contractor with a report on the suitability of the material as a granular base, and a sieve analysis.

12.2.2 Gradation

Granular base material shall consist of crushed rock and/or crushed gravel and sand consisting of hard, clean, durable material, free from coatings of silt, clay, or other deleterious materials, and containing no organic matter. The base course aggregate shall meet the following gradation requirements when tested to ASTM C136 and C117, (AASHTO T11 and T27).

Sieve No. (mm)	Passing By Mass (%)
20.00	100
12.500	64 - 100
5.000	36 - 72
1.250	12 - 42
0.315	4 - 22
0.080	3 - 6

A tolerance of 3% in the amount passing the maximum screen size will be allowed if all the material passes a sieve with 6 mm larger opening. A minimum of 60% by weight of the material retained on the 5.000 sieve shall have at least one freshly crushed face. The material shall have a liquid limit not greater than 25 (ASTM D423-66) and a plastic limit not greater than six (ASTM D424-59).

Base course aggregate with a length to thickness ratio of greater than 5 should be limited to 15% by mass.

A minimum of 60% by weight of the material retained on the 5,000 sieve shall have at least two freshly crushed faces. Other properties shall be as follows:

Liquid Limit	Maximum 25, ASTM D423-66
Plasticity Index	Maximum 6, ASTM D424-59
Los Angeles Abrasion	ASTM C131-76
Gradation “B”	35% maximum loss by mass
Sand Equivalent	Minimum of 35% ASTM D2419-74

A tolerance of 3% in the amount passing the maximum screen size will be allowed if all the material passes a sieve with 6 mm openings.

12.2.3 Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject o field tests taken at the discretion of the Engineer. Materials may be considered unsuitable, even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated, if any characteristic precludes satisfactory compaction, or if the material fails to provide a roadway suitable for traffic. The Engineer shall determine the acceptability of the final material.

12.3 Construction

12.3.1 Placement

The granular base course material shall not be placed until the underlying layer has been inspected and approved for compaction and stability by the Engineer. Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding 150 mm compactive depth. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

12.3.2 Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the Engineer. The material shall be compacted near the optimum moisture content to 98% Standard Proctor Density.

12.3.3 Shaping and Finishing

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until it has dried sufficiently. If the moisture content is below the optimum, water shall be added by an acceptable applicator to achieve the specified moisture content. A motor grader shall be used in conjunction with compaction equipment to keep the finished surface of each layer even and uniform. The finished surface of the granular base course shall conform to the required cross-section and grade as shown on the drawings and as staked by the Engineer, within a tolerance of plus or minus 20 mm.

Proof roll surface at final grade in presence of Engineer or Geotechnical Engineer.

Maintain finished surfaces in condition conforming to this section until succeeding surface or layer is applied.

12.4 Tests

The Engineer, or their representative, will carry out field density, moisture content, and sieve analysis tests to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be at minimum 1 test per 100 metres of constructed roadway, sidewalk, or pathway and at various locations left and right of centreline, or as directed by the Engineer.

Engineer or Owner may increase frequency of testing at their sole discretion based on performance and/or site conditions.

Before approval by the Engineer, the granular base shall be true to grade and cross-section. The grade shall conform to the compaction requirements.

Contractor to provide quality control testing for imported granular base materials at the rate of 1 suite of testing for every 500 cubic meters hauled to site covering the requirements of Section 12.2.2. Tests to be taken onsite. Test results are to be supplied to the Engineer within twenty-four (24) hours of completion of tests. Payment will be withheld due to lack of testing or lack of results.

Proof rolling:

For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.

Obtain written approval from Engineer to use non-standard proof rolling equipment.

If use of non-standard proof rolling equipment is approved, Engineer to determine level of proof rolling.

Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire or as directed by Engineer.

Where proof rolling reveals areas of defective granular base course or granular sub-base course, remove and replace as directed by Engineer.

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13.1 Scope

The work described in this section pertains to granular sub-base material for roadway construction.

13.2 Materials

13.2.1 Granular Sub-Base

Granular sub-base is that course of material lying above the subgrade and below the base course. The gradation to be utilized shall be as designated by the Engineer.

13.2.2 Samples

Before any granular material is used in the work, the Contractor shall obtain and ship to an approved testing laboratory representative samples containing not less than 25 kg. Sampling shall be done in accordance with the current issue of ASTM D75. The laboratory shall provide the Engineer, and Contractor with a report on the suitability of the material as a granular sub-base, and a sieve analysis.

13.2.3 Gradation

The following gradations shall apply to the crushed granular sub-base course

Sieve Size (mm)	Passing By Mass (%)
50.000	100
25.000	55-100
12.500	42-84
5.000	26-65
1.250	11-47
0.315	3-30
0.080	0-8

The following gradation shall apply to the pit run granular sub-base course.

Sieve Size (mm)	Passing By Mass (%)
200.000	100
80.000	75-100
25.000	55-100

Sieve Size (mm)	Passing By Mass (%)
12.500	42-84
5.000	26-65
1.250	11-47
0.315	3-30
0.080	0-8

Aggregate with a length to thickness ratio of greater than five should be limited to 15% by mass. The depth of granular sub-base shall be as noted on the drawings. Alternate depths for granular sub-base will be used to replace unsuitable subgrade. Prior to placing granular sub-base material in such areas, it may be necessary to install a Geotextile fabric.

13.2.4 Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject o field tests taken at the discretion of the Engineer. Materials may be considered unsuitable, even though particle sizes are within the limits of the gradation sizes required, if any characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. The Engineer shall determine the acceptability of the final material.

13.2.5 Quality

Material shall consist of durable rock or gravel. The granular sub-base shall not contain any organic or other deleterious material. The material shall have a minimum California Bearing Ratio of 55% at the specified compaction as determined by the current issue of ASTM D1883.

13.2.6 Filter Fabric

The synthetic filter fabric shall be as specified and shown on the cross-section drawing. The material selected is to be suitable to the task and shall be approved by the Engineer.

13.3 Installation

13.3.1 Placement

The granular sub-base course material shall not be placed until the underlying layer has been inspected and approved for compaction and stability by the Engineer. Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding 150 mm in thickness before compaction. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader. Materials shall not be placed or worked so that the aggregate becomes

segregated.

13.3.2 Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the Engineer. The material shall be compacted near optimum moisture content to 98% Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until the material has been dried sufficiently. If the moisture content is below optimum, water shall be added by an acceptable applicator to achieve the specified compaction.

13.3.3 Shaping and Finishing

A motor grader shall be used in conjunction with the compaction equipment to keep the finished surface of each layer even and uniform. The finished surface of the granular sub-base shall conform to the required cross-section and grades as shown on the construction drawings and as staked, within a tolerance of 30 mm.

13.3.4 Placement of Filter Fabric

The areas to be covered by the synthetic filter fabric shall be trimmed and dressed to the lines and grades shown on the construction drawings, or as required by the Engineer. The synthetic filter fabric shall be placed on the dressed surfaces to cover the areas that are to receive the granular sub-base. The fabric shall be laid overlapped a minimum of 500 mm at all joints to provide a full, continuous mat, and shall be laid smooth and free of tension, stress, folds, wrinkles or creases. Securing pins and washers shall be inserted through both strips of overlapped fabric at not greater than 1-meter intervals to prevent slippage of the fabric on down slopes. Each securing pin shall be pushed through the fabric until the washer bears against the fabric firmly and secures it to the foundation. The filter fabric shall also be overlapped as specified or welded at the seams.

The fabric shall be placed with the longer dimension parallel to the centreline of the roadway, and shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. The strips shall be placed to provide a minimum width of 500 mm overlap for each joint.

The first layer of fill is to be applied using the end-dump method on firm ground and should be spread by a low ground pressure vehicle. The first layer should be evenly distributed, should be up to 500 mm in thickness, and should not contain large rocks or other foreign objects. Type or class of filter fabric shall be as specified by the Engineer.

13.4 Tests

The Engineer, or their representative, will carry out field density, moisture content, and sieve analysis tests to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be at minimum 1 test per 100 metres of constructed roadway, sidewalk, or pathway and at various locations left and right of centreline, or as directed by the Engineer.

Engineer or Owner may increase frequency of testing at their sole discretion based on performance and/or site conditions.

Before approval by the Engineer, the granular sub-base shall be true to grade and cross-section. The grade shall conform to the compaction requirements.

Contractor to provide quality control testing for imported granular base materials at the rate of 1 suite of testing for every 500 cubic meters hauled to site covering the requirements of Section 13.2. Tests to be taken onsite. Test results are to be supplied to the Engineer within twenty-four (24) hours of completion of tests. Payment will be withheld due to lack of testing or lack of results.

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15.1 Scope

The work described in this section pertains to the construction of concrete curbs, gutters, sidewalks, crossings, and paving stones.

15.2 Materials

15.2.1 Portland Cement

Portland Cement shall meet the requirements of CSA Standard A5-M Portland Cement and shall be Type 10 normal or Type 50, sulphate resistant as determined by a Geotechnical Engineer.

15.2.2 Aggregates

Fine aggregate shall meet the requirements of CSA Standard CAN3-A24.1-M77, Clause 5.3. Coarse aggregate shall meet the requirements of CSA Standard CAN3-A23.1-M77, Clause 5.4. Aggregate size shall conform to nominal size 28,000 to 5,000 sieve grading in Group 1 of Table 3 of this CSA standard.

Sieve No. (mm)	Passing By Mass (%)
40.000	100
28.000	95 -100
14.000	30 - 65
5.000	0 - 10
2.500	0 - 5

15.2.3 Water

Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalies, organic material, or other deleterious substances.

15.2.4 Admixtures

Air-entraining admixtures shall conform to CSA Standard CAN 3-A266.1-M78. Chemical admixtures, if used, shall conform to CSA Standard CAN 3-A266.2-M78. Calcium chloride shall conform to the requirements of CSA Standard CAN 3-A266.2-M78. The use of pozzolans in concrete is not permitted.

15.2.5 Reinforcing Steel

Reinforcing bars shall be deformed bars in accordance with CSA Standard Specification G30.12-M1977. Cold drawn wire or welded wire fabric for concrete reinforcement shall conform to the requirements of CSA Standard Specification G30.3-1972.

15.2.6 Expansion Joint Filler

Joint filler shall conform to CGSB Standard Specification for polyurethane sealing compound #19-GP-15 or ASTM Standard Specification for SIKA FLEX 1A.

15.2.7 Membrane Curing Compound

Resin-base impervious curing compound shall conform to ASTM Standard Specification C309 Type 1D-Type B. The curing compound shall contain white fugitive dye.

15.2.8 Preformed Expansion Joint Filler

Preformed expansion joint filler shall conform to ASTM Standard Specification D-1752.

15.2.9 Levelling Course

The levelling course material shall be a maximum of 25 mm in depth and shall consist of sand, crusher screenings, or other approved material meeting the following requirements.

Sieve No. (mm)	Passing By Mass (%)
20.00	100
12.500	64 - 100
5.000	36 - 72
1.250	12 - 42
0.315	4 - 22
0.080	3 - 8

A minimum of 60% by weight of the material retained on the 5.000 sieve shall have at least two freshly crushed faces.

Additional properties that shall be met are as follows:

Liquid Limit	Maximum 25, ASTM D423-66
Plasticity Index	Maximum 6, ASTM D424-59
Los Angeles Abrasion Gradation “B”	35% maximum loss by mass, ASTM C131-76
Sand Equivalent	Minimum of 35%, ASTM D2419-74

15.3 Concrete

A qualified testing laboratory engaged by the Contractor shall design concrete mixes. The mix design shall be submitted to the Engineer for approval a minimum of 10 days prior to delivery of any concrete to the site. Exterior concrete shall be C2 exposure class concrete. The specified compressive strength at 28 days shall be 32 MPa. The strength level of 32 MPa shall be achieved if averages of all sets consecutive strength tests equal or exceed the specified strength, and no individual strength test is less than 27 MPa.

The concrete shall contain not less than 315 kg of Portland Cement per cubic metre of concrete produced.

The air content of the concrete shall be maintained between the limits of 5 to 7%.

The minimum slump permissible will be that which will allow the concrete to be placed efficiently and provide a homogeneous mass. The maximum allowable slump shall be 60 mm +/- 10 mm for all hand-poured concrete and 30 mm +/- 10 mm for all machine-poured concrete.

15.3.1 Retempering with Air

If, due to a low air entrainment percentage, as described in Section 15.3, the Engineer feels it is necessary to add an approved air-entraining agent on site, placement of concrete shall stop to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the air content of the concrete not conform to Section 15.3 after retempering the concrete shall be rejected.

The Engineer has the right to withdraw permission to add an air-entraining agent to the mix and reject the concrete if, in his opinion, this practice is being abused.

15.3.2 Retempering with Water

If, due to a low slump as described in Section 15.3, the Engineer feels it is necessary to add water to the mix, it shall be injected into the drum under such pressure and direction of flow that it conforms to the specifications in ASTM C-94, Appendix XI. Placement of concrete shall stop at that point to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the slump of the concrete not conform to Section 15.3, after retempering the concrete shall be rejected.

The Engineer has the right to withdraw permission to add water to the mix and reject the concrete if, in his opinion, this practice is being abused.

15.4 Concrete Block Paving

Concrete Paving Blocks: conforming to ASTM C936, solid concrete interlocking paving units and with particular requirements as follows:

- Cement: Type 10 Portland Cement conforming to CAN3-A5-M77.
- Aggregates: Normal density aggregates, conforming to CAN3-A23.1-M77. Source and gradation shall be submitted to the Engineer for approval prior to casting.
- Air-entraining Agent: Conforming to CAN3-A23.1 -M77.

- Dimensional Tolerance: Manufactured blocks shall be true to shape and shall not differ from manufacturer's standard dimensions by more than +/-2 mm in length and width and +/-2 mm in thickness.
- Shape: Type A, dentated and interlocking on all four faces, resists joint spreading in either direction, and can be laid in herringbone pattern. According to manufacturer's specific shape, subject to Engineer's approval. The Engineer may also specify or accept shapes other than type A.
- Colour: Subject to Engineer's approval.
- Size: According to manufacturer's standard size, subject to Engineer's approval.

15.4.1 Paving Stone Bedding and Joint Sand

15.4.1.1 Bedding Sand

Bedding sand shall be clean, sharp sand that is suitable for concrete making, free of deleterious soluble salts and other contaminants likely to cause efflorescence, and graded within the following limits:

Sieve No. (mm)	Passing By Mass (%)
10.000	100
5.000	95 - 100
2.500	80 - 100
1.250	50 - 85
0.630	25 - 60
0.315	10 - 30
0.160	5 - 15
0.063	0 - 10

15.4.1.2 Joint Sand

Joint sand shall be sharp sand free of deleterious soluble salts and other contaminants likely to cause efflorescence and reduced skid resistance, graded within the following limits:

Sieve No. (mm)	Passing By Mass (%)
2.500	100
1.250	85 - 100
0.630	50 - 90
0.315	25 - 90

Sieve No. (mm)	Passing By Mass (%)
0.160	12 - 30
0.063	10 - 15

15.4.2 Subgrade Preparation

The finished subgrade surface shall not deviate by more than 15 mm from the bottom edge of a 3 m straight-edge laid in any direction, and shall be on correct grade, or not more than 10 mm below grade.

15.4.3 Finished Paving Tolerances

Finished concrete paving stones shall conform to the following tolerances:

- Maximum deviation from specified grade: +/-10 mm
- Maximum deviation from under a 3 m straightedge: 8 mm
- Maximum differential level between two adjacent units: 2 mm
- Defects: The Contractor shall remove and replace defective and damaged materials.

15.5 Construction

15.5.1 Subgrade

Beds for the sidewalks, curbs, and driveways shall be excavated and prepared to the lines and cross-sections on the plans or as designated by the Engineer.

Unsuitable material shall be removed and replaced as designated by the Engineer. The subgrade shall be uniformly compacted to provide a firm base for all concrete and paving stone work.

Subgrade, granular subbase, granular base course shall be compacted to 98% of Standard Proctor Dry Density.

The subgrade elevation shall be finished to tolerances requiring zero to 25 mm of levelling course material on the subgrade. This material shall be compacted by means of a vibratory packer.

Vertical or sloping faces shall be cut within 25 mm of the proposed back of curb. This cut shall be formed in material compacted to 98% Standard Proctor Dry Density.

When curb and gutter are placed on compacted gravel, crushed gravel may be used for fine grading. Any gravel fill shall be compacted near the optimum moisture content to 98% Standard Proctor Dry Density.

15.5.2 Placing Concrete

The concrete shall be placed within 1.5 hours of initial mixing at the plant, or before the drum on the concrete truck has turned 300 revolutions. Complete discharge of concrete shall not exceed two hours. The concrete shall be transported by methods, which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.

Concrete shall be placed continuously until a complete section between expansion joints has been poured.

Concrete shall not be placed until the condition of the subgrade satisfies Section 15.5.1. The subgrade shall be sufficiently moist to prevent absorption of water from the concrete, and free from mud or water ponding.

The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods, which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as near as practicable to its final position to avoid rehandling.

The sequence of concrete placement shall be arranged so that concrete, which has partially hardened, shall not be subjected to injurious vibration.

The vertical free fall height of concrete shall not exceed 1.0m. For falls greater than 1.0m, chutes or tremies shall be used.

During placement, concrete shall be sufficiently tamped or vibrated with suitable equipment to secure a close bond with the reinforcement, eliminate entrapped air voids, and ensure a homogeneous structure with adequate consolidation.

The rate of delivery of mixed concrete shall be such that the interval between the placing of successive truckloads shall not exceed 30 minutes. If the time exceeds 30 minutes, then a construction joint shall be formed at the end of pour.

After the initial set of the concrete, neither the forms nor the concrete structure shall be jarred and no strain shall be placed on the ends of projecting reinforcement.

15.5.3 Reinforcing

10 M deformed reinforcing rods shall be placed as specified in the construction drawings. Welded wire fabric shall be placed in commercial crossings as shown on the construction drawings.

15.5.4 Joints

Curb, gutter and sidewalk contraction joints shall be constructed at 3.0 m intervals and as detailed on the construction drawings, and shall not be less than 50 mm deep. Midway between each contraction joint on the sidewalk, a surface joint, 13 mm deep, shall be constructed. These joints shall not extend through the curb and gutter. Contraction joint widths shall not be greater than 5 mm.

A surface joint shall be constructed longitudinally at the location shown on the construction drawings and shall continue through all driveways and lane crossings.

A construction joint shall be formed at the end of every pour. This joint shall be constructed in a "V" shape, as directed by the Engineer.

The joint spacing at the end of a pour may vary from that specified by the following:

- If the end of the pour falls within 300 mm of the required joint spacing, the distance between the last two joints shall be averaged.
- If the end of the pour falls within 800 mm of the required joint spacing, the distance between the last three joints shall be averaged. In special cases, the location of the end of the pour shall be as specified by the Engineer.

When it is necessary to construct longitudinal construction joints in a walk, 10 M bars 600 mm long shall be placed transverse to the joint every meter and penetrate each slab by 300 mm.

Where a sidewalk or divider is to be constructed, abutting existing curb, a 10 mm wide by 30 mm deep slot shall be formed between the back of the curb and the walk or divider. This slot shall be filled with the joint filler specified in Section 15.2.6. 10 M bars at 500 mm on centre shall be dowelled and epoxied into the back of the existing curb prior to placing concrete.

15.5.5 Finishing

Sidewalk surfaces, either separate or combined with curb and gutter, shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings and as staked by the Engineer. The surface shall be consolidated and smoothed using a wood float. Light-steel trowelling shall be used followed by a uniform brush finish. Sidewalk shall be edged at all joints to prevent chipping of the concrete.

The exposed surfaces of concrete curbs and gutters, either separate or monolithic with sidewalks, shall be finished by means of a wood floating, light-steel trowelling, and uniform brushing, and all edges shall be rounded to the required radius. No patching will be allowed.

Crossings to lanes and private property shall be struck off and screeded to the required slope and cross-section. The finished surface shall be brushed as specified above.

All edges, including contraction or surface joints, shall be tooled for a width of 50 mm and rounded to a radius of 6 mm. The brush grooves shall be transverse on the sidewalk and longitudinal on the curb and gutter. The finished surface shall have no exposed aggregate or honeycomb.

If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.

Surface grooves made by the broom shall not be more than 3 mm deep. Before brushing, all surplus water shall be removed from the brush.

15.5.6 Special Effects

Concrete surfaces where specified, shall be Boca Pink or approved similar colour, stamped concrete to basket weave using brick pattern, unless specified otherwise on the drawings.

15.5.7 Backfilling

Unless otherwise directed by the Engineer, the Contractor shall backfill along the back of the curb edges, to the top of the concrete, within 3 to 7 days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of 150 mm, to a minimum of 95% Standard Proctor Density and to a distance of 300 mm from the back of the walk or curb. Where landscaping is to be carried out immediately after completion of the walks or curbs and gutters, the backfilling shall be left 100 mm low to allow for the topsoil.

15.5.8 Curing

Immediately after finishing, the concrete surface shall be protected by applying a membrane curing compound. Immediately after removal of the forms, all exposed surfaces shall be thoroughly wetted with water and then sprayed with membrane curing compound. The membrane-curing compound shall be applied in accordance with the manufacturer's instructions.

The curing compound shall be applied under pressure with a spray nozzle in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate which shall depend on the roughness of the surface of the concrete, but in no case at less than 0.25 liters per square meter of concrete surface.

15.5.9 Mechanical Extruding Machines

If an extruding machine is used in constructing curbs, curb and gutter, sidewalk or combined curb and sidewalk, the material excavated to accommodate the machine shall be either stockpiled at a specified location or windrowed to the centre of the street with a minimal disruption to traffic. After the installation of the concrete works, the excavated material shall be replaced to the original street grade or to the elevations designated by the Engineer and compacted to not less than the specified Standard Proctor Density at optimum moisture content. Any granular material, which may have existed, shall be replaced on the street. Backfill material required behind curbs or sidewalks shall be hauled in from surplus stockpiles or from a location designated by the Engineer. Appurtenances shall be located, examined for deficiencies, and staked by the Contractor prior to work beginning on a particular section, and any deficiencies noted shall be reported to the Engineer immediately.

Upon completion of a block of work, the structures shall be relocated and inspected with the Engineer.

The Contractor shall repair any damage, which may have occurred during the concreting operations as well as any deficiencies not previously reported to the Engineer.

When using extruding equipment, the requirements below apply in addition to those in Sections 15.2.1 to 15.3.2. Slip-form paving machines or concrete, extruding machines may be used for placing concrete provided they meet the following requirements and have received the approval of the Engineer prior to commencement of the work:

- The vibrators on the equipment shall be capable of producing a dense mass with a smooth surface, free of honeycombing.
- The equipment shall include automatic grade and line controls, which shall be used at all times.

Any special grading or preparation of the clay or gravel base required by the Contractor to accommodate his equipment shall be the responsibility of the Contractor, and he shall restore the roadway and boulevards to their original condition within 10 days of the initial disturbance. The Contractor shall replace any gravel base contaminated by clay or other material.

Whenever possible the forming and placing of concrete by conventional methods (as may be required at corners, driveways and catch basins) shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the "tie-ins" shall be completed within 3 days of construction of the adjacent extruded section. The hand pours of the said "tie-ins" shall be completed in one continuous pour.

15.5.10 Hand Forming

15.5.10.1 Forming

Forms shall be of steel or wood of sufficient strength to resist the pressure of wet concrete, and the supply shall be sufficient to permit their remaining in place until hydration has occurred, or longer if the Engineer considers it necessary. The Contractor shall remove all face forms to allow for a smooth brush finish. The use of bent, twisted, battered or worn-out forms will not be permitted. The Engineer will check forms for alignment and elevation before concrete is poured, and shall be cleaned and oiled before each use.

Where required, reinforcement shall be secured in the location shown on the construction drawings and shall be free from mill scale, grease and rust prior to placing concrete. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed. The Engineer or his representative must approve forms before concrete is poured.

Curbs having a radius of less than 40 m shall be constructed with flexible forms. A sufficient length of form (not less than 50 metres) shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well staked, braced,

or otherwise held rigidly true to the established line and grade. The Engineer may, at any time, reject the use of any forms he considers unsatisfactory.

15.5.10.2 Consolidation

The concrete shall be consolidated by means of an approved vibrating screed or, in the case of curb and gutter only, by means of a poker or pencil vibrator not exceeding 50 mm in diameter.

Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense, smooth surface.

Vibrations shall be of sufficient duration to thoroughly compact the concrete but not long enough to cause segregation. Vibrators shall not be used for moving concrete.

15.6 Inspection

The Contractor with a 3 m straightedge shall check all exposed concrete surfaces, and any water pockets or deviations in line or grade exceeding a total of 6 mm shall be corrected immediately. Differences in elevation at any given point from that given by the design shall not exceed 13 mm, and the maximum variation shall not be greater than 13 mm.

Deviations in horizontal alignment at any given point from that given by the design shall not exceed 25 mm, and the fluctuations in the horizontal alignment shall not be greater than 25 mm.

Concrete not meeting the above criteria shall be replaced.

15.7 Field Tests

A qualified testing laboratory in accordance with the following shall perform testing:

- Samples of concrete shall be obtained in accordance with CSA Test Method A23.2-1C for sampling plastic concrete.
- Test cylinders shall be made and stored in accordance with CSA Test Method A23.2-3C for making and curing concrete compressive and flexural test specimens.

  No less than one strength test shall be made from samples from each 100 cubic metres of concrete placed, and in no case, shall there be less than one test from each day's pour. Engineer may adjust frequency of testing. Each strength test shall consist of three test cylinders, 1 tested at 7 days and 2 at 28 days. When the cold weather requirements of Section 15.9 are in place 5 cylinders shall be cast with two cured in the field. Lab cured cylinders 1 tested at 7 days and 2 at 28 days. 7 day field cured cylinders, 1 tested at 7 days, 1 at 28 days. The field-cured cylinders to meet the 32 MPa specification.
- Air content determinations shall be made in accordance with CSA Test Method A23.2-7C, air content of plastic concrete by the volumetric method.

During construction start-up, every load or batch of concrete shall be tested until satisfactory control of the air content has been established. Air content tests taken with the test cylinders will be sufficient once satisfactory control has been established. Whenever a test falls outside the specified limits, the testing frequency shall revert to one test per load or batch until satisfactory control is re-established. Any concrete that falls outside specified air control levels in accordance with Section 15.3 shall be rejected from use.

Slump tests made in accordance with CSA Test Method A23.2-5C, Slump of Concrete, shall be made in conjunction with each strength test.

15.8 Cleanup

As the work progresses, the Contractor shall clean up the site and all areas in which work has been done shall be left in a neat and presentable condition. All gutters and street drainage ditches that have been blocked because of the Contractor's operation shall be restored or repaired.

The Contractor shall dispose of all surplus excavated material, organic soil, rock, boulders, and pieces of concrete and masonry at an approved location.

15.9 Cold Weather Requirements

When the temperature of the surrounding atmosphere is at or below 5 degrees Celsius, the aggregate and the mixing water shall be heated. The aggregate and mixing water shall have a temperature of not less than 5 degrees Celsius and be entirely free of frozen materials. The aggregate shall not be heated to more than 60 degrees Celsius, and the concrete when deposited in the forms shall have a temperature of not less than 10 degrees Celsius nor more than 38 degrees Celsius. The concrete shall be maintained at a temperature of 10 degrees Celsius for not less than 4 days after placing.

15.10 Protection

The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 3 days after the concrete has been finished.

15.11 Deficiency Penalty for Insufficient Concrete Strength

Where there are variations from specified design strength, the following Deficiency penalty shall be assessed based on the 28-day, laboratory-cured cylinders.

- When the concrete strength of any set exceeds 95% of design strength, no deficiency penalty will be administered.
- When the concrete strength of any set is greater than 80% but less than 95% of design strength, the deficiency penalty will be administered as follows:

$$\frac{Q\,[P \times 2\,(A - B)]}{A}$$

Where: P = unit price

A = specified strength
B = average 28-day cylinder strength
Q = Quantity of deficient concrete

- If the concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected and replaced by the Contractor

SECTION 16 – BITUMINOUS COATING

Table of Contents

16.1 Scope

Prime coat shall be the application of bituminous material to a previously prepared base course, in preparation of placing surfacing materials.

Tack coat shall be the application of bituminous material on asphaltic surface.

16.2 Materials

16.2.1 Prime Coats and Tack Coats

16.2.1.1 Description

Prime coat is the application of bituminous material to previously prepared granular base course prior to placing asphalt surfacing.

Tack coat is the application of asphalt material to a previously constructed paving surface of any type in preparation for placing asphalt surfacing, and against curb gutter faces, manholes, valves and other appurtenances in the street to be paved.

16.2.1.2 Prime Coat

The bituminous material for priming the granular base course shall be liquid asphalt. The asphalt types may vary from M.C. 30 to M.C. 250; from SS-1 to SS-1H or an emulsified asphalt primer to suit the conditions of the base. The rate of application may vary from 0.50 to 1.00L/sq.m. Temperature of application shall fall within the following limits:

- Medium Curing Asphalt:
M.C. 30 - 51 to 70 degrees Celsius
M.C. 70 - 75 to 90 degrees Celsius
M.C. 250 - 100 to 110 degrees Celsius

- Emulsified Asphalt:
SS-1 - 25 to 55 degrees Celsius
SS-1H - 24 to 54 degrees Celsius

-Emulsified Asphalt
Primer: - 15 to 50 degrees Celsius

16.2.1.3 Tack Coats (Over Asphalt Base)

The asphalt for the tack coat may vary from SS-1 to SS-1H and from R.C. 30 to R.C. 250, depending on conditions to suit the base. The rate of application shall be 0.25 to 0.90L/sq.m. Temperature of application shall fall within the following limits:

- Rapid Curing Asphalt:
R.C. 30 - 50 to 70 degrees Celsius
R.C. 70 - 75 to 90 degrees Celsius
R.C. 250 - 100 to 110 degrees Celsius

- Emulsified Asphalt:

SS-1 - 24 to 54 degrees Celsius
SS-1H - 24 to 54 degrees Celsius

16.2.2 Sand Cover

The materials for sand cover shall consist of clean, granular material approved by the Consultant. All sand cover shall pass a 5.000 mm sieve.

16.3 Equipment

Distributors shall be equipped with a separate power unit for the pump and full circulating spray bars. The spray bars on the distributor shall be controlled by a bootman riding at the rear of the distributor in such a position that operation of all sprays is in his full view. Cleaning equipment shall consist of power brooms, flushers and whatever hand scrapers may be necessary to remove all foreign material.

The pressure distributor used for applying asphaltic material shall distribute the asphaltic material in a uniform spray without atomization, in the amounts and within the limits of temperature specified. Suitable means for accurately measuring the temperature of the asphaltic material shall be provided at all times by the Contractor.

The thermometer well shall be placed so as not to be in contact with a heating tube. The distributor shall be so designed that the normal width of application shall be not less than two metres, with provision for the application of a lesser width when necessary.
If provided with heating attachments, the distributor shall be so equipped and operated that the asphaltic material shall be circulated or agitated throughout the entire heating process.

16.4 Preparation

16.4.1 Tack Coat

The surface shall be free from foreign material prior to application of the tack coat. Traffic may be permitted to run on completed coat immediately after the asphalt has cured or at a time determined by the Consultant.

16.5 Construction

The asphalt primer or tack coat shall be applied only when the surface is dry or slightly damp, unless otherwise allowed by the Consultant in writing, or only when the air temperature in the shade is above 10 degree Celsius. The application temperature of the asphalt primer coat shall be as specified by the manufacturer.

To ensure uniformity of application, a drip pan shall be inserted under the nozzles when the application is stopped, and building paper shall be spread over the treated surface to allow sufficient distance on restarting so that the nozzles are operating at full force when the untreated surface is reached. The building paper shall then be removed and destroyed. A narrow-spout pouring pot or hand spray shall be used to apply primer material necessary to touch up any spots unavoidably missed by the distributor Work adjacent to the roadway shall be completely protected from the application operation by means of a suitable covering. Any unnecessary splashing of the concrete shall be cleaned at the Contractor's expense. The

Contractor shall maintain the primed surface until the surface course has been placed. Maintenance shall include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.

16.5.1 Tack Coat

The asphalt tack coat shall be applied uniformly by means of an approved distributor at a rate of 0.23 to 0.70 litres per square metre. The asphalt tack coat may be either SS1 to SS1h, or RC 30 to RC 250, depending on conditions to suit the base. Tack coat shall not be applied until the base has been inspected and approved by the Engineer.

16.5.2 Sand Cover

The asphalt primer should preferably be entirely absorbed by the base course and, therefore, require no sand cover. If, however, the asphalt has not been completely absorbed 24 hours after application, sufficient sand shall be spread over the surface to blot up excess asphalt and prevent it from being picked up by any traffic.

Part 1 General

1.1 SECTION INCLUDES

1.2 SCOPE

.1 The work described in this section is that required for construction of a warm mix asphaltic concrete surface course.

.2 Warm Mix Asphalt (WMA) is the generic term used to describe the typical reduction in production, placement and compaction temperatures obtained through the application of WMA technologies usually described as foaming processes, organically modified mixes, or chemically modified mixes.

.3 WMA mixing temperatures are those typically within the range of 20 to 50°C lower than conventional hot mix asphalt.

Part 2 MATERIALS

2.1 AGGREGATES

.1 Approval

.1 The Contractor shall submit to the Engineer at least ten work days before start of paving, a mix design using the Marshall Method and performed by an independent testing laboratory acceptable to the Engineer. The Contractor shall submit a separate mix design for each change in the supplier or source of materials. No mixing of asphaltic concrete shall proceed until the Engineer approves the job mix formula or any subsequent changes.

.2 Preliminary approval of the aggregate as represented by the samples shall not constitute general acceptance of all material in the deposits or source of supply; acceptance shall be subject to field tests taken at the discretion of the Engineer. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction, or if the material fails to provide a pavement suitable for traffic. The Engineer will determine the acceptability of the final material.

.3 Aggregate shall consist of hard, durable, uniformly graded, crushed gravel, and shall not contain organic or soft materials that break up when alternately frozen and thawed, or wetted and dried, or other deleterious materials.

2.2 Gradation

.1 Coarse aggregate is aggregate retained on the 5.000 mm sieve. Fine aggregate is aggregate passing the 5.000 mm sieve. Fine aggregate shall contain manufactured or crushed fines at a percentage by mass of fine aggregate of minimum 70%. Aggregate shall be hard, clean, durable, free from coatings of silt, clay or other deleterious materials, and shall contain no organic matter. The combined aggregates shall meet the following gradation requirements when tested to ASTM C136 and C117.

SIEVE SIZE (mm)	PASSING BY MASS (%)
12.500	100
5.000	55-75
2.000	35-55
0.400	15-30
0.160	5-16
0.080	3- 8

.2 Additional properties that shall be met are as follows:

Liquid Limit	Maximum 25, ASTM D423-66
Plasticity Index	Maximum 6, ASTM D424-59

Los Angeles Abrasion Gradation "B"	35% maximum loss by mass, ASTM C131- 76
Sand Equivalent	Minimum of 35% ASTM D2419-74
Magnesium Sulphate Soundness - Coarse Aggregate - Fine Aggregate	 Maximum 12% Maximum 16%, ASTM C88-77
Absorption of Coarse Aggregate	Maximum 1.75%, ASTM C127-77
Lightweight Particles(Specific gravity less then 1.95)	Maximum 3% by mass, ASTM C123-69 (1975)
Flat Particles	Length to thickness ratio greater then 5, maximum of 15% by mass
Loss by Washing	1.5% maximum passing the 0.08 sieve, ASTM C117-80
Crushed Fragments	60% minimum material retained on the 5.000 mm with 1 crushed face

.3 A minimum of 70% of material retained on the 5.000 mm sieve shall have at least two crushed faces.

.4 Aggregate shall be hard, clean, durable, and free from clay and coatings of silt, clay, or other deleterious materials, and shall contain no organic matter.

.5 When coarse aggregate grading is such that the material will tend to segregate in stockpiling or handling, such aggregate shall be supplied in two or more sizes. Each size of coarse aggregate required to produce the combined gradation specified above shall be placed in individual stockpiles satisfactory to the Engineer. When it is necessary to blend two or more coarse aggregates before placing them in the cold bins, the blending shall be done through separate bins at the cold elevator feeders, and not in the stockpile.

.6 When it is necessary to blend fine aggregates from one or more sources to produce the combined gradation specified, each source or size of fine aggregate shall be placed in individual stockpiles at the plant site, and separated by bulkheads or other means satisfactory to the Engineer. The blending shall be done through separate bins at the cold elevator feeders and not in the stockpile.

.7 If the Contractor elects to use an approved drier-drum asphalt mixing process, the designated aggregates shall be split on the 5.000 mm sieve, and each material shall be stockpiled separately so that intermixing of each size and type does not occur. The coarse aggregate stockpile shall contain no more than 20% passing the 5.000 mm sieve, and the fine aggregate stockpile shall contain no more than 20% retained on the 5.000 mm sieve. At least 2,000 tonnes of aggregate shall be placed in each stockpile prior to the start of mixing operations.

.8 The Contractor, during the crushing and splitting process, shall provide a convenient means for accurately and representatively:

.1 Sampling the individual coarse and fine aggregate streams, and the combined aggregate stream in its proper proportion;

.2 Sampling the individual coarse and fine aggregate streams and weighing the total amounts of both coarse and fine materials being produced.

2.3 Mineral Filler

.1 Mineral filler shall be added in the mixing plant if the aggregate gradation is such that its addition is necessary to meet the above specifications. Mineral filler shall consist of Portland Cement, possolan, commercially ground stone dust or other mineral dust approved by the Consultant. Mineral filler shall have a plasticity index of zero and shall meet the following gradation requirements:

SIEVE NO. (mm)	PASSING BY MASS (%)
0.400	100
0.160	90 - 100
0.080	70-100
0.045	62 - 100

2.4 ASPHALT CEMENT

.1 The asphalt cement shall be uniform in character, free of water and shall not foam when heated to 175 degrees Celsius. It shall meet the following specifications:

Viscosity	500+ poises, 60 degrees Celsius at 30 cm vacuum, ASTM D2171
Penetration	150A-200A, 100g in 5.0 sec. At 25 degrees Celsius, ASTM D5
Flash point	205+ degrees Celsius, ASTM D92
Thin film over test	ASTM D1754
Penetration	40+% of original, 100 g in 5 sec. At 25 degrees Celsius, ASTM D5
Ductility	100+ at 25 degrees Celsius, ASTM D113
Solubility in trichloro-ethylene	99.5% ASTM D2042

2.5 STORAGE

.1 No stacking conveyor shall be used to stockpile aggregate for a continuous mix or drum plant. Reference to continuous mix plant in Section 17.4.0 shall also include drum plant.

.2 The aggregate shall be stockpiled at the mixing plant in such a manner that no segregation of the various particle sizes is produced. The asphalt binder shall be stored in suitable tanks at a temperature not exceeding 150°C.

2.6 DESIGN MIX

.1 A qualified testing laboratory shall be employed to prepare a mix design and job mix formula for the aggregate on which the tender is based. The mix design and job mix formula shall be submitted to the Engineer for approval a minimum of ten days prior to paving. No paving shall commence before the Engineer's approval is given for the mix design or job mix formula. The Engineer may also require a trial batch.

.2 The laboratory mix design shall be based on the Marshall Method. Absorption of asphalt into the aggregate shall be taken into account using the ASTM bulk specific gravity of the aggregate in calculating optimum asphalt content.

.3 The mix design shall meet the following specifications:

	RANGE
Max size of aggregate (mm)	12.5
Number of compaction blow each end of specimen	50
Stability (kN) at 60 degrees Celsius	4.5
Minimum Retained Stability (%)	75
Flow (0.25 mm unit)	8-16
% Voids total mix	4.0 ± 1.0
%Voids in mineral aggregate	14.5 min
% Aggregate voids filled with asphalt	73-85
Minimum film thickness[2] (μm)	7.0

.4 The job mix formula shall be posted in a conspicuous place within sight of the plant operator. The Engineer must approve any subsequent changes in writing. The job mix formula shall list the following information:

.1 Batch Plants:

.1 The sieve analysis of the combined aggregate in the mix

.2 The aggregate size range in each bin separation to be used

.3 The weight of the material to be used from each bin for 1 batch of mix

.4 The weight of asphalt to be used in each batch

.5 The mixing from the temperature

.6 Viscosity relationship for the asphalt

.2 Continuous Mix Plants:

.1 The weight of asphalt per tonne of mix

.2 The mixing temperature of the asphalt mix as determined from the temperature-viscosity relationship for the asphalt

.3 The setting of the feed systems

.5 Proportions for a continuous-feed mixing plant shall be determined on the basis of a field trial, which shall be carried out at least 48 hours prior to placing the mix on the job site.

.6 The volumetric settings of the aggregate and asphalt shall be determined by the Contractor and approved by the Engineer. These settings shall be interlocked, so that a change in the volume of aggregate automatically results in a corresponding change in the volume of asphalt.

.7 The mix produced shall conform to the job mix formula approved by the Engineer and to the following tolerances:

.1 The weight of aggregate from any bin, as well as the total weight of aggregate for each bin, shall not vary from the job mix formula by more than:

SIEVE SIZE (mm)	VARIATION BY MASS (%)
10.000 and larger	+/-7
5.000 to 10.000	+/-5
2.000 to 0.160	+/-4
0.063	+/-2

.2 The percent of asphalt in the mix shall not vary by more than 0.3% from the percentage indicated in the approved mix design.

.3 The mixing temperature for asphaltic materials shall not vary from those specified in the job mix formula by more than nine degree Celsius. In no case shall the mixing temperature exceed the maximum mix temperature indicated from the asphalt temperature-viscosity curve data.

.8 The Engineer shall have the ability to request that a trial batch be produced and be tested the first time the asphalt mix design is being used for the season or at any time it is found that the actual asphalt mix is deviating from the mix design.

2.7 ASPHALTIC BINDER DATA

.1 Temperature-viscosity data or curves, as obtained from the refineries, for the various grades and types of asphaltic material to be used shall be made available to the Engineer.

2.8 TEST DATA

.1 The Contractor shall submit all test data performed by the accredited testing company to the Engineer within 72 hours of receiving results.

2.9 CHANGES

.1 The Contractor shall notify the Engineer of all proposed changes in the mix proportions. No changes shall be made until a representative of the Engineer is there to witness the change.

2.10 MIXING PLANT

.1 The paving plant shall be of a type capable of consistently meeting or exceeding all of the requirements of these specifications.

2.11 WARM MIX ASPHALT PRODUCTION

.1 Produce WMA by combining aggregates with asphalt cement modified by one of the processes described hereunder and using additives or processes that are accepted by at least one Canadian provincial MOT or U.S. state DOT for use in the production of WMA and ensure the same after-compaction physical properties as hot mix asphalt concrete produced using asphalt cement as specified in this Section.

.2 For foaming processes, provide to the Engineer for approval at least 30 days prior to starting production, a quality control plan which includes but is not limited to:

.1 The manufacturer's established water injection target rate, or water bearing/water based additive proportion.

.1 Assurance that potable water will be used in water injection systems.

.2 Target production temperature rate for the plant.

.3 Target temperature range for compaction.

.4 Any modifications required to plant.

.5 Method of monitoring the injection system or water bearing/water based additive proportion and method of stopping production in event of a failure of system.

.6 If using water injection process, assurance that the water will inject into the asphalt binder flow before the asphalt binder spray makes contact with aggregate. Water will not be allowed to come in contact with aggregate prior to binder spray.

.7 Copy of MOT or DOT approved products list showing acceptance of warm mix process proposed for this project or a letter from the MOT or DOT indicating that the process has been accepted by them for use with WMA.

.3 For organic or chemical additives, provide to the Engineer for approval at least 30 days prior to starting production, a quality control plan which includes but is not limited to:

.1 Identify proposed additives.

.2 Copies of the additive suppliers' production specifications, highlighting where those specifications differ from this Section.

.3 One sample of the additive. Size of sample will depend on the additive.

.4 Target production temperature rate for the plant.

.5 Target temperature range for compaction.

.6 Method of monitoring the additive amount introduced to the mix, and method of stopping production in event of a failure of system.

.7 Copy of MOT or DOT approved products list showing acceptance of warm mix additive proposed for this project or a letter from the MOT or DOT indicating that the additive has been accepted by them for use with WMA.

.4 Notwithstanding where this Section may conflict with WMA technology provider specifications for production of WMA, the WMA technology provider specifications will take precedence.

.5 Ensure that only one WMA foaming process or WMA additive regime is used unless approved by the Engineer.

2.12 TRANSPORTATION

.1 The mixture shall be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. The vehicle shall be suitably insulated, and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions.

.2 The inside surface of the box may be lubricated with a light coating of soap or detergent solution; petroleum derivatives shall not be permitted. Any accumulation of asphaltic material, which has collected in the box, shall be thoroughly cleaned before loading with hot mix. Trucks shall be clean of mud or any substance, which could contaminate the working area.

2.13 PLACING

.1 Unless otherwise permitted by the Engineer, a mechanical self-powered paver shall spread the mixture. The paver shall have an automatic levelling device and automatic grade control capable of spreading the mix without segregation or tearing, in thickness varying from 12 mm to 150 mm and in widths greater than 3.0 m and to true line, grade and cross-section as shown on the plans.

.2 The mixture shall be laid at a temperature not lower than 120 degrees Celsius or higher than 140 degrees Celsius. The atmospheric air temperature shall not be less than 2 degrees Celsius and rising, no frost shall be present and the road surface shall be dry.

.3 Where the asphaltic surface course is to be placed in two lifts, the first lift shall be placed, finished and compacted for the full width as shown on the drawings, prior to commencing on the second lift. The maximum lift thickness is 75 mm.

.4 In placing the second lift, the individual mixture spreads shall be aligned in a manner such that the longitudinal joints in each layer will not coincide.

.5 In narrow areas, deep or irregular sections, intersections, turnouts, or driveways, where it is impractical to spread with a paver, the Contractor may use hand methods as directed by the Engineer.

2.14 WEATHER LIMITATIONS

.1 The mixture shall not be placed:

.1 during periods of rain or when there is an imminent danger of rain;

.2 during excessive winds; or

.3 when air temperature is 2 degrees Celsius or cooler or frost is present on the surface.

2.15 BASE PREPARATION

.1 Where tack coat or prime coat is applied, it shall be thoroughly cured prior to placing the mixture. The Contractor shall remove all loose and foreign material and water. Where existing pavements are to be overlaid, a levelling course of hot mix asphaltic concrete may be required prior to placing the surface course. Unless otherwise approved by the Engineer, this course shall be laid with a paving spreader and shall meet all the requirements of this section.

2.16 SURFACE REQUIREMENTS

.1 Prior to the addition of material to any mat, the surface shall be broken with the tines of a rake to ensure proper bonding. Edges against which additional pavement is to be placed shall be straight and approximately vertical. A lute rake shall be used immediately behind the paver, when required, to obtain a true line and vertical face.

2.17 HAND SPREADING

.1 In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Engineer. The material shall be distributed uniformly to avoid segregation of the coarse and fine aggregates. Broadcasting of material shall not be permitted. During the spreading operation, all material shall be thoroughly loosened and uniformly distributed by a lute rake. Material that has formed into lumps and does not break down readily shall be rejected.

2.18 ROLLING

.1 The rollers used for compaction shall be self-propelled steel-wheeled or rubber-tired rollers, providing at least 35 Newtons per millimetre width of tread. The roller shall be in good condition, without backlash when reversed, and shall be operated by a competent rollerman. The wheels shall be kept properly moistened, but excess water or oil will not be permitted. The rollers must be kept in continuous operation as nearly as practicable, and all parts of the pavement shall receive substantially the same compaction. Rolling shall be done at a maximum speed of 5 km per hour.

.2 At least one self-propelled steel-wheeled roller shall be used for every 40 tonnes of asphaltic concrete laid per hour. Rolling shall start as soon as the pavement will bear the roller without checking or undue displacement, working from the low part or edge to the high part or edge continuously until no roller marks are left in the finished surface and no further compaction is possible. Where width permits, the pavement shall be rolled diagonally in two directions. At all curbs, manholes and other appurtenances, and at all locations not accessible to the rollers, hand tampers shall be used to produce the same density as provided by the roller. Where the asphaltic concrete is laid in more than one lift, each lift shall be so compacted.

2.19 PROTECTION OF APPURTENANCES

.1 The Contractor shall protect all exposed appurtenances with a suitable cover to prevent the bonding of asphalt to the surface. This includes valve boxes, manholes, and concrete curbs. The Contractor shall consider exposed valve boxes and manhole covers to protect them from roller damage while compacting the first layer of asphalt.

2.20 JOINTS

.1 The mixture shall be laid so that all longitudinal joints are made while the first mat of the two being laid is still hot. A narrow strip along the edge of a mat, which is joined with another asphalt mat, shall be left without rolling until the adjoining mat has been placed against it. The joint, which is formed, shall be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt is still hot.

.2 Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints shall be straight-edged to assure smoothness and true alignment and shall be offset at least one metre from joints of adjacent mats.

.3 In order to ensure that the surface shall not become cooled prior to laying an adjacent "run", the spreader shall not advance beyond the limits shown in the table below unless directed by the Engineer, i.e. on collector or arterial roads:

Air Temperature (°C)	Maximum Length of Advancement (m)
Above 27	250
15 - 27	190
7 - 15	125
Below 7	90

.4 All concrete or metal structures such as gutters, manholes, etc. shall be painted with an approved bituminous material prior to placing the asphalt.

2.21 CLEANUP

.1 Locations shall be cleared of all excess material resulting from the paving operation, including if directed by the Engineer, flushing of sanitary and storm mains to remove debris. Flushed debris is to be collected in manholes and removed from the site. Any

damage to the Engineer's or private property caused by the Contractor shall be repaired to the Engineer's satisfaction within 3 days of the date of completion of the street or lane. Failure to clean up may result in other crews undertaking this work without notice to the Contractor and at the Contractor's expense.

Part 3 TOLERANCE AND PENALTIES

3.1 THICKNESS

.1 The pavement shall have the thickness specified on the construction drawings. Areas suspected to be deficient shall be cored, as directed by the Engineer, on the basis of one core for every 1000 square metres of pavement. At least one core shall be taken at the designated Marshall location.

.2 Should the asphalt be found to be deficient in thickness the Contractor will be permitted to take two additional asphalt cores in an effort to limit the amount of the asphalt penalty. The location of the two additional cores shall be located within the same asphalt mat as the original deficient core and shall be located no more than half way between the deficient core and the next adjacent core or contract boundary. Within these two parameters, the exact core locations are to be determined by the Contractor and approved by the Engineer.

.3 A deficiency penalty shall be assessed according to the following:

Asphalt Thickness	Tolerance Deficiencies	Deficiency Penalty
50 mm	47 to 35 mm	$[C-[A^2/B^2]*C] * Q$
50 mm	Under 35 mm	Replacement by Contractor
75 mm	71 to 53 mm	$[C-[A^2/B^2]*C] * Q$
75 mm	Under 53 mm	Replacement by Contractor
100 mm	95 to 70 mm	$[C - [A^2 / B^2] * C] * Q$
100 mm	Under 70 mm	Replacement by Contractor

Where: A = Average core thickness
B = Specified core thickness
C = Contract unit price
Q = Quantity of deficient HMAC

.4 For any cores of a thickness greater than specified, the specified thickness shall be used for the purpose of all calculations and averages.

.5 No additional payment will be made to the Contractor for thickness greater than specified.

.6 The Contractor shall fill all core holes within a maximum period of 24 hours.

3.2 DENSITIES

.1 Densities shall be based on core samples, each of which shall represent approximately 1000 square metres per constructed lift. Asphalt densities are specified as 98% of the standard laboratory Marshall. A minimum of one Marshall per day shall be performed with one core sample taken at a designated Marshall location.

.2

.3 If any core fails to meet the density specified, two additional cores shall be taken within one metre of the first core sample, and the average density of the three cores shall represent the area. No additional rolling, to achieve a more favourable density, shall be allowed, WITHOUT the WRITTEN CONSENT OF THE ENGINEER.

.4 If the densities are less than specified, a deficiency penalty shall be assessed according to the following:

.1 $[-0.041[X-98]^2]U.P.] * Q$

Where : U.P. = Unit Price

X = Actual Asphalt Density (%)

Q = Quantity

.5 All asphalt below 95% standard Marshall density shall be removed and replaced at the Contractor's expense.

3.3 SMOOTHNESS

.1 The surface of the compacted pavement shall be true to the required grade and cross-section with a smooth riding quality acceptable to the Engineer.

.2 In addition to the above, when checked with a 3.0 metre straightedge, held in successive positions parallel or perpendicular to the centreline and in contact with the surface, the pavement surface shall not deviate from the straightedge by more than 3 mm.

.3 If, in the opinion of the Engineer, an objectionable riding surface exists, the Contractor shall either grind and resurface with asphalt overlay or remove and replace the asphalt surface.

3.4 TEXTURE

.1 The completed pavement shall have a tightly knit texture and shall be free from segregation and surface cracking. The Contractor’s Consultant shall redesign Mixes that are excessively tender or difficult to roll. The new design shall meet all of the requirements of this section, and shall be submitted to the Engineer for approval at least three working days prior to its use.

.2 Classifying pavement segregation:

.1 A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement. For the purposes of classifying pavement segregation, only segregated areas greater than 0.1 m^2 and centre-of-paver streaks greater than 1 m long will be considered.

.2 Moderate or severe segregated areas which do not meet these size parameters will be considered obvious defects. Pavement segregation will be classified as follows:

.1 "Slight": The matrix, asphalt cement and fine aggregate is in place between the coarse aggregate. However, there is more stone in comparison to the surrounding acceptable mix.

.2 "Moderate": Significantly more stone than the surrounding mix; moderately segregated areas usually exhibit a lack of surrounding matrix.

.3 "Severe": Appears as an area of very stony mix, stone against stone, with very little or no matrix.

.4 "Centre-of-Paver Streak": Appears as a continuous or semi-continuous longitudinal "streak" typically located in the middle of the paver "mat".

.3 Inspections for pavement segregation

.1 Inspections by the Contractor

.1 The Contractor shall perform a daily inspection of the paving operations on all lifts of pavement to identify any instances of pavement segregation. If segregation is evident, the Contractor shall take immediate corrective action to his operations to identify the cause and prevent any further occurrence of segregation.

.2 Inspections by the Engineer

.1 Inspections during construction

.1 The Engineer will inspect the pavement to identify any instances of pavement segregation. If segregation is evident, the Engineer will immediately notify the Contractor so that corrective action can be taken to prevent further occurrence of segregation.

.2 Typically, each pavement Lot would be inspected as soon as possible after the Lot is placed. During the inspection(s), the Engineer will identify and record any areas of moderate and severe segregation and any areas of center-of-paver streak. Areas requiring repair in accordance with 1.3.5.4 will be marked. The Engineer will provide the Contractor with a written assessment (location and severity) of the segregated areas as soon as possible following each inspection.

.2 Inspection following construction

.1 The Engineer will conduct a second inspection of the top lift, normally one week after the substantial completion of paving work. During this inspection, the Engineer will identify and record any areas of slight, moderate and severe segregation and any areas of centre-of-paver streak which were not identified in the inspections during construction. The Engineer will provide the Contractor with a written assessment (location and severity) of

the segregated areas as soon as possible following this inspection.

.4 Repairing pavement segregation

.1 Pavement segregation, obvious defects, deteriorated repairs or failures identified during the inspection performed approximately one week after substantial completion of paving operations will require repair.

.2 Pavement segregation identified in the inspections performed during construction shall be repaired at the Contractor's expense and in accordance with the following:

.1 Moderate and severe segregation in the top lift of pavement and on entrances and intersections shall require repair.

.2 For entrances and the portion of intersections outside the through travel lanes and shoulders, areas of moderate and severe segregation shall be repaired in accordance with the methods of repair listed for moderate segregation. Intersections and entrances shall also be neatly shaped, smooth and free of surface defects and depressions.

.3 Slight segregation on any lift of pavement will not require repair.

.4 Moderate segregation on lower lifts will not require repair.

.5 Severe segregation on lower lifts will only require repair in instances where, in the opinion of the Engineer, the segregated area will affect the long term structural integrity of the pavement structure. Such repair will not be required in instances where the Engineer determines that the paver screed is "dragging" due to distortion of the existing surface.

.6 Only moderate and severely segregated centre-of-paver streak on the top lift of pavement will require repair.

.7 Methods of repair

.1 Moderate Segregation - The Contractor has the option of using a slurry patch or a WMA patch.

.2 Severe Segregation - The Contractor has the option of removal and replacement or overlay.

.3 Any other methods of repair proposed by the Contractor will be subject to the approval of the Engineer.

.8 The Engineer will mark out the area of repair. The "marked area" will extend a minimum of 0.5 metres beyond the segregated area. For centre-of-paver streak, the "marked area" will extend a minimum of 100 mm laterally and 0.5 metres longitudinally beyond the streak.

.9 Cut the pavement so that all edges are vertical, the sides are parallel to the direction of traffic and the ends are skewed between 15-25 degrees. Coat edges with a tack coat conforming to Section 08040 and allow to cure.

.10 Repairs for segregation using an overlay shall be for the entire pavement width. Repairs for segregation using removal and replacement shall be for the full lane width, full lane width and shoulder or the shoulder only as applicable, depending on the extent of the segregated area. The full

depth of the asphalt lift shall be removed and replaced with new WMA pavement using an appropriate paver and cold milling equipment.

.11 All repairs shall be regular in shape and finished using good workmanship practices to provide an appearance suitable to the Engineer. Traffic shall be kept off all repairs for a sufficient period of time to ensure that tracking does not occur.

.12 All WMA patching and other repairs for which compaction is normally required shall be properly compacted.

.13 In the event repairs cover existing roadway lines or markings, the Contractor shall reinstate the lines and markings at his expense and to the satisfaction of the Engineer.

.14 Repairs shall be completed during construction or shortly after construction, except when prevented by inclement weather or seasonal shutdown. In these cases, the Contractor shall complete the repairs prior to June 15 of the following year.

.5 Segregation payment holdback

.1 Payment holdbacks of up to 25% of each progress payment may be withheld until the final product is accepted by the Engineer. If deficiencies are identified during the inspection approximately one week after substantial completion, the payment will be held until the deficiencies are repaired and meet specification requirements. If no deficiencies are identified during the inspection approximately one week after substantial completion, the payment will be released within two weeks of the inspection.

.2 Payment holdbacks for pavement segregation will apply to deficiencies identified in the top and bottom lift of WMA pavement. Segregated areas, centre-of-paver streak and any repaired segregated areas identified by the Engineer either during construction or during the inspection conducted approximately one week after substantial completion of paving work, will be used to determine payment holdbacks.

.6 Payment for work that had been rejected, but was made acceptable

.1 When defects have been remedied in Lots or Sublots which had been rejected, the work will no longer be considered deficient. Acceptable work will not delay the release of payment. Deficiencies identified in the inspection approximately one week after substantial completion require repair prior to release of the payment holdback.

.7 Repair of failed areas in existing surfaces

.1 Repair of failed areas in existing surfaces will be paid for at the Contract unit prices bid for the work.

.8 Finish surface quality tolerances

.1 Finished asphalt surface to be inspected after final rolling at selected locations.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 4.5 m straight edge placed between any two contacts.

.9 Defective work

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.

.2 Repair areas showing checking or hairline cracking.

.3 Asphalt pavement not meeting the specified compaction, thickness, segregation or finish surface quality tolerances may be required to be replaced or overlaid at the Contractor's expense.

.10 Cored areas

.1 Contractor shall fill all core holes with WMA material immediately after the core has been removed from the road surface. Compaction and finished surface quality are required to meet density specifications and surface quality specifications.

3.5 TRAFFIC

.1 No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.

END OF SECTION

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19.1 Scope

This section specifies the requirements for the supply and installation of traffic control and street identification signs.

19.2 Materials

19.2.1 Signs

Traffic control and street identification signs shall conform to the standards of the RTAC Manual of Uniform Traffic Control Devices for Canada (metric edition) and shall be fabricated of steel or aluminium with high-intensity, diamond grade, reflective facing.

19.2.2 Sign Posts

Signposts shall be galvanized steel channel. The length of post shall be as required to give the specified clearance from the road surface to the sign and provide sufficient anchorage. The signs shall be attached to posts using 2 – 9 mm "Tuff Nut" security nuts, bolts, washers, and channel spacers. Spacers shall be such that the channel does not deform when the nuts are tightened.

19.2.3 Post Anchors

If ground conditions are such that the signposts cannot be installed by driving the posts into the ground, or the ground will not support the posts, the Contractor shall provide concrete post anchors. The post shall be embedded sufficiently in the concrete. The concrete shall be formed and buried to provide adequate support for the sign.

19.2.4 Breakaway Posts

Franklin EZE erect breakaway posts, Marion steel minute man breakaway post system, or approved equivalent shall be used on all traffic control and street identification signs as stated on the plans or as shown in the specifications. All breakaway posts are to be installed as per the construction drawings.

19.3 Installation

19.3.1 Timing

The Contractor shall coordinate with the Engineer the installation of new traffic signs. The Contractor shall notify the Engineer 48 hours in advance of the installation.

19.3.2 Sign Erection

Signs shall be mounted at a height specified by the Engineer and at a location as indicated in the construction drawings. Breakaway posts shall be driven into the ground as shown on the construction drawings, where possible, or post anchors shall be constructed to form a stable foundation. The breakaway posts shall be plumb and installed at locations shown on the drawings or as directed by the Engineer. Street identification signs shall be banded to streetlights using two 5 mm stainless steel bands, or directly onto posts as per traffic control signs.

The pre-drilled boltholes shall be punctured from the painted side of the sign when installing the signs to the steel posts.

SECTION 22 – PAVEMENT MARKING

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22.1 Scope

The work described in this section pertains to the supply and application of materials for pavement markings.

22.2 Materials

Paint to be used for pavement marks to be in accordance with the following standards:

- To CGSB 1-GP-74M+Amdt-May-81, alkyd traffic paint.
- To CGSB 1-GP-149M, alkyd reflectorized traffic paint.
- Colour: to CGSB 1-GP-12C+Amdt-DEc-84 (yellow 505-308) (black 512-301) (white 513-301)

Upon request, Engineer will supply a qualified product list of paints applicable to work. Qualified paints may be used, but the Engineer reserves the right to perform further test.

Thinner: to CGSB 1-GP-5M
Glass beads: Overlay type to CGSB 1-GP-74M+Amdt-May-81.

22.3 Samples

Submit to the Engineer the following material sample quantities at least (2) two weeks prior to commencing work.

- Two 1 litre samples of each type of paint.
- One 1 kg sample of glass beads.

The sampling is to be done in accordance with the procedure outlined in CGSB 1-GP-71+Amdt-Jun-83.

Clearly mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

22.4 Installation

22.4.1 Equipment Requirements

Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single or double and dashed lines that will ensure uniform application and having a positive shut-off.

Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

22.4.2 Condition of Surface

The Contractor is to clean the pavement surface as to be free from surface water, frost, ice, dust, oil, grease, and other foreign materials.

22.4.3 APPLICATION

Unless otherwise approved by the Engineer, apply paint only when air temperature is above 5°C and no rain is forecast.

Apply traffic paint evenly at a rate of 3 L/m_2.

Do not thin paint unless approved by Engineer.

Symbols and letters to conform to dimensions indicated.

Apply other specified marking materials as directed by the Engineer.

Paint lines to be of uniform colour and density with sharp edges.

Thoroughly clean distributor tank before refilling with paint of different colour.

Apply glass beads at a rate of 770 g/l of paint.

Apply paint and reflecting glass beads using specified equipment only.

Ensure all pavement markings in accordance with latest edition of TAC Manual of Uniform Traffic Control Devices.

22.4.4 Tolerance

Paint markings to be within plus or minus 12 mm of dimensions specified.

Remove incorrect markings.

22.4.5 Protection of Completed Work

Protect pavement markings from traffic until dry.

Maintain markings in new condition until final acceptance of the work is achieved.

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28.1 Scope

This section specifies requirements for power, and telecommunications installation.

Installation of Shallow Utility Infrastructure is to be installed under the guidance and periodic direction of the Utility Representative. All construction drawings and quantities provided in Tender Documents are “Not for Construction”. The Contractor shall not expect full time site presence by the Utility. The Contractor shall provide Full Time site representation by a Certified Raceway Technician, or Yukon Registered Journeyman Electrician, or a Red Seal Journeyman Powerline Technician. Any site representation shall have a minimum of 3 years of relevant underground civil installation experience and acceptable to the Engineer. Lack of suitable site representation will result in suspension of Work and/or withheld payments.

Work includes the installation of pre-cast street light bases, pre-cast switch mod vaults, Pre-cast Switch cubicle vaults precast single-phase transformer vaults, pre-cast three-phase transformer vaults, telecommunication pedestals, grounding systems, pull-boxes and associated conduits for primary power, secondary power, street lighting, and telecommunication systems. The Contractor is required to coordinate all works under this section with the appropriate utility companies - ATCO Electric Yukon and Northwestel.

The complete work under this section shall be governed by the dictates of good practice in all details and materials and methods even if not specified. The work shall be properly coordinated with the requirements of other units of work specified in other sections.

28.2 Location & Coordination

The location of the proposed utilities is shown on the construction drawings, or as directed by the Utility Engineer.

Any changes or deviations shall be approved by the Utility Engineer or Representative.

Requests for shutdown and/or supervised excavations for shallow utilities require a minimum of 2-week written notice to the utility in advance of the required work.

28.3 Quality Assurance

Utility installations shall be in accordance with applicable National or local code requirements and these specifications. All work performed shall meet the requirements of the local utility company overseeing the work.

All work related to primary power, secondary power and street lighting shall conform to the specifications of the typical details Engineer approved drawing. Equipment installation and grounding details are enclosed.

Photos will need to be submitted for all equipment installed. Location of each piece of equipment must be identified on the photo and a location by survey.

28.4 Materials

28.4.1 Electrical Conduit and Fittings

Conduits, couplings, bends and caps shall be 100 mm and 50 mm diameter DB2 PVC, or as supplied by the Utility Companies. Couplings, bends and caps shall be of the same material. All bends shall be long radius sweeps with a minimum radius of 1.0 m. All required conduits shall be supplied by the Utility companies.

28.4.2 Concrete Bases

Concrete bases shall be supplied by ATCO Electric Yukon as per the standard details. Precast bases for street lamps will be 5ft, 7ft or 9ft lengths. Precast equipment bases and vaults will be as per the standard details.

28.4.3 Ground Rods and Connectors

Ground rods and connectors shall be supplied by ATCO Electric Yukon as per the standard details. Ground rod connectors will be of the “Ampact” type. The Contractor shall supply the proper explosive activated “Ampact” tool and documentation attesting to the qualifications of the tool operator. Proper connection of the Ampact will be reviewed by ATCO Electric Yukon qualified personnel. All ground rods are coupled together in 4ft sections and will require a proper ¾” pin pounding tool.

28.4.4 Ground Wire

Ground wire shall be supplied by ATCO Electric Yukon as per the standard details.

28.4.5 Marking Tape

Marking tape shall be installed approximately 500 mm below final grade - above ducts in accordance to the standard details for trenching. The utility companies shall supply marking tape.

28.4.6 Concrete

Shall be used for concrete encasement around ducts where proper clearances are not met. Any concrete encased ducts will be installed under the direct supervision of the Utility Representative.

Compressive strength of 20 MPa at 28 days.
Use Type GU Normal Cement.

Concrete shall be supplied by contractor.

28.4.7 Sand

Supply and place a minimum of 150mm stone-free sand above and below the conduit.
Berm the trench line where possible, to minimize the void is sloughing occurs.
Sand – 5.000mm sieve but larger than 0.080mm sieve shall be classified as sand.
Sand to be supplied by contractor.

28.5 Installation

28.5.1 General

All construction drawings will be provided by the Utility in a Construction Package, complete with the current typical details approved by that Utility's' Engineer.

No Work shall commence, or materials released until a minimum of two weeks' notice is given for a startup meeting. This meeting will be to go over the approved Construction Package with the Utility Construction Supervisor, Utility Representative and the Contractor. The Contractor shall have a certified electrical worker, approved by ATCO Yukon Electric, on site to ensure proper electrical equipment installation. The Utility Construction Supervisor or Utility representative will require a construction schedule for the installation of all shallow utilities prior to the start of the project.

28.5.2 Grade and Alignment

Install all utilities to the line and grade as shown on construction plans or as directed by the Utility Engineer or Utility Company qualified representative. Minimum depth of bury to be 1 meter from finished grade to top of highest conduit in the trench.

Conflicts with trench alignments will be brought to the attention of the Utility or Utility Representative.

The quantity and size of conduits are as indicated on the construction drawings and will dictate the necessary depth and width of trenches.

28.5.3 Trenching and Backfill

All trenching shall be in accordance with the attached trenching detail. All trenches shall be of sufficient width to accommodate vibratory compaction equipment suitable to achieve 98% Standard Proctor Density.

All trenches shall be dug to provide a minimum of 150 mm of compacted sand below and above the installed conduits. Where stacking of conduits is required the contractor shall install intermediate spacers to ensure proper duct separation.

The Engineer will complete compaction testing of trench backfill. Compacted backfill, which fails to meet minimum compaction requirements, will be excavated and re-compacted at the Contractor's expense, and retested. Costs related to retesting of backfill will be borne by the Contractor.

28.5.4 Conduit Installation

The Owner reserves the right to dictate where the work will start and end, in consultation with the utilities, and the sequence and progression of the work as it relates to underground utilities.

All conduit joints are to be glued except the stub-off bend, see the typical details drawings for clarification. Install all conduits in accordance with the standard details

and these specifications, and as directed by the Utility Engineer or the Utility Representative.

When directed, encase conduits in concrete.

After installation and backfilling, ensure all conduits are clean by blowing sufficient air / piston through conduits to remove any dirt or debris from conduits. Proper duct blowing system must be used. System must include 2'' and 4'' pistons as approved by ATCO Yukon Electric. Install pull strings in all conduits. All open ends of conduits and bases shall be securely taped over or capped to prevent entrance of dirt and debris. All conduits are to be clearly marked at both ends with identifiers unique to each conduit; a marking strategy will be established prior to construction with each label identifying direction of travel and depth. Payment for conduit installation shall only occur upon sign off by ATCO Yukon Electric representative.

28.5.5 Concrete Base Installation

Street lamp bases shall be installed at the location and elevation shown on the drawings or as directed by the Utility Engineer or the Utility Representative. Bases shall be installed vertical, level and square to the roadway. Bases shall be set such that the top taper is 25 mm above the adjacent curb or sidewalk elevation, or 100 mm above the grade of the surrounding landscaping as shown on the typical details drawing.

Precast equipment bases shall be installed at the location and elevation shown on the drawings or as directed by the Utility Engineer or the Utility Representative. Bases shall be installed level and square to the roadway.

Ground level boxes shall be installed at locations shown on drawing. When setting a minimum of 150mm pea gravel placed bottom of base for drainage. Top of boxes placed 25-50mm above final grade elevation. Boxes placed level and square to roadway.

28.5.6 Clean Up and Restoration

Any pavement, sidewalks, curbs or paving stone cut or otherwise disturbed as a result of this work shall be restored as required by these specifications and to the satisfaction of the Utility Engineer, Utility Representative and Engineer.

Any private landscaping disturbed as a result of this work must be restored to the satisfaction of the property owner and the Utility Engineer, Utility Representative and Engineer.

Cooperate with the utility companies to complete the removal of existing overhead lines and poles once all underground utilities have been installed and commissioned.

AECOM

ISSUED FOR USE

GEOTECHNICAL EVALUATION
WHISTLE BEND SUBDIVISION
WHITEHORSE, YT

W14101171

August 2009

EBA Engineering Consultants Ltd.
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1.0 INTRODUCTION

EBA Engineering Consultants Ltd. has completed a pre-design geotechnical evaluation of the 700 hectare Whistle Bend Subdivision study area and has addressed geotechnical concerns pertinent to specific off-site servicing issues relative to the proposed residential subdivision development. Work completed and recommendations related to this project are presented in this report.

1.1 AUTHORIZATION

Authorization to proceed with this assignment was provided by Mr. Tom Becker, MCIP of AECOM by email on May 16, 2008.

1.2 SCOPE OF WORK

The scope of work for this study is consistent with EBA's proposal dated March 18, 2008, which was accepted by AECOM. Tasks include:

- Phase 1 – "Concept Development & Community Consultation": EBA's scope of work included the collection of existing geotechnical data and input into the off-site engineering report. Subsequent to discussions with AECOM team members, it was agreed that off-site issues to be addressed included the possible upgrades to the Valleyview and Porter Creek Reservoirs; the extension of existing watermains for water supply and fire suppression; the geotechnical evaluation of alternative access roads to the site; alternative water supply for fire suppression; storm water retention and disposal, and the location of area gravel sources.
- Phase 2 – "Detailed Planning and Engineering Pre-Design": EBA's scope of work included a terrain risk assessment of the study area and the completion of a geotechnical evaluation to determine soil and groundwater conditions throughout the development area and the preparation of a report addressing geotechnical aspects pertinent to subdivision development.

2.0 COLLECTION OF EXISTING REPORTS

2.1 OFF-SITE REPORTS

Existing information collected and reviewed in order to address the offsite engineering issues listed above (refer to the Phase 1 scope of work) includes:

- Terrain mapping from the Southern Lakes series terrain maps and Agricultural Branch surficial terrain map for the Whitehorse area
- 1995 Geotechnical Evaluation – Rangeway Road Reconstruction (EBA File: 0201-95-11731) – a total of eleven boreholes were advanced, with six boreholes drilled along the

existing Rangeway Road corridor between Wann Road and the bus turn-around located next to the Northlands Trailer Park.

- 2004 Geotechnical Evaluation – Phase III Section of Porter Creek Watermain (EBA File: 1200125) – a total of three boreholes were advanced in the immediate vicinity of the existing Porter Creek reservoir (one by EBA and two by others).
- 2005 Geotechnical Evaluation – Pine Street Extension - Porter Creek Area D (EBA File: 1200138) – desktop study including the delineation of terrain and geotechnical conditions between the Alaska Highway at the Kopper King Trailer Court extending east to Mountainview Drive.

2.2 EXISTING REPORTS WITH RELEVANT WHISTLEBEND STUDY AREA INFORMATION

Information collected and reviewed for this evaluation includes:

- Terrain mapping from the Southern Lakes series terrain maps and Agricultural Branch surficial terrain map for the Whitehorse area
- 1975 Geotechnical Evaluation – Porter Creek Lagoon (EBA File: E-1022) – a total of four boreholes were advanced
- 1988 Geotechnical Evaluation – Porter Creek Lagoon Sludge Pit (EBA File: 0201-4904) – three testpits excavated throughout proposed sludge pit
- 1995 Geotechnical Evaluation – Rangeway Road Reconstruction (EBA File: 0201-95-11731) – a total of eleven boreholes were advanced, with 6 boreholes drilled along the existing Rangeway Road corridor between Wann Road and the bus turn around located next to the Northlands Trailer Park, as well as five additional boreholes drilled along the proposed golf course access road
- 1995 Geotechnical Evaluation – Porter Creek Transfer Pipeline, Whitehorse Sewage Treatment Facility (EBA File: 0201-95-12025) – six boreholes were drilled on the Porter Creek side of the river and are considered pertinent to the Lower Bench evaluation

3.0 SITE DESCRIPTION

3.1 SITE LOCATION

The Porter Creek Bench area of Whitehorse, as identified in the 1987 and 2002 OCP's is bordered between the Yukon River on the east side, Range Road on the west side, the McIntyre Creek valley on the south side and the Porter Creek Sewage Outfall Line access road on the north side.

3.2 SITE HISTORY

The study area is predominantly undeveloped. However, the area is located next to the Mountainview Golf Course and is home to a decommissioned sewage lagoon in the

northwest corner of the site; a CBC transmitter site; a NavCan aircraft beacon; the Horse and Rider Association facility; the Heiland Farm, as well as Ta'an Kwach'an and Kwanlin Dun First Nation settlement lands. Power line right-of ways and numerous trails dissect the site and are utilized for recreational purposes.

4.0 FIELD WORK

The geotechnical field investigation program was completed in two phases. Phase 1 included a four day borehole drilling program completed between December 8, 2008 and December 11, 2008. A total of 20 boreholes were drilled to various depths utilizing a Nodwell Mounted CME 75 drill rig owned and operated by 15317 Yukon Inc. of Whitehorse, Yukon. Phase 2 included the excavation of a single testpit in the kettle depression located close to the Golf Course on March 24, 2009. On March 27, 2009 an attempt was made to drill a single borehole in the area along the south side of the Valleyview Reservoir. However, the amount of snow along the roadway up to the reservoir parking lot restricted access to the site so this borehole could not be completed.

Details of the site investigation completed to address the off-site engineering issues and the site specific Whistle Bend investigation program are summarized in the following sections.

4.1 OFF-SITE ENGINEERING DRILLING & TESTPITTING PROGRAMS

Drilling and testpitting programs completed to address off-site engineering issues included:

- On December 8, 2009 three boreholes were drilled in the vicinity of the alternate access road route (borehole locations based on the November 14, 2008 preliminary concept plan prepared by AECOM) connecting Mountainview Drive and Range Road to ensure the roadway could be cut to an elevation that would comply with appropriate geometric design standards. The actual access road location has been moved slightly south but the data collected from borehole W14101171-BH01, –BH02 and –BH-03 is still considered relevant.
- On December 9, 2009 four boreholes were drilled along Range Road close to McIntyre Creek in order to assess potential for horizontal directional drilling (HDD) during water line upgrades to the Whistle Bend Subdivision. Borehole W14101171-BH04 was drilled along the north side of Range Road east of McIntyre Creek, W14101171-BH05 was drilled within 2 m of the actual water course of the south side of Range Road and boreholes W14101171-BH06 and –BH07 were drilled on the east side of Range Road north of McIntyre Creek.
- On March 24, 2009 a single testpit was excavation in the base of the kettle depression located near the north end of the golf course. Originally, this investigation was to assess the kettle depressions found along the northern perimeter of the study area as a possible fire suppression water source. However, cost benefit analysis has subsequently eliminated this as an option so the depression is being considered as a storm water disposal site.

At each testhole location, detailed logs were prepared describing the geotechnical (soil, groundwater and bedrock) conditions encountered. Representative soil samples were collected at regular intervals throughout the depth of each testhole and upon completion; the testholes were backfilled to grade and flagged for future reference.

4.2 ON-SITE GEOTECHNICAL INVESTIGATION

Within the actual Whistle Bend Subdivision area, EBA has good testhole coverage for the northwest quadrant (13 testholes for the old Porter Creek Sewage Lagoon & Sludge Pit site as well as the outfall line to the new Sewage Lagoon) and the south end of the site (8 testholes along Range Road and the Golf Course Access Road).

To augment the existing testhole data, thirteen additional boreholes were drilled to a depth of between 6 m and 7.5 m to establish soil conditions throughout the central portion of the proposed subdivision. This work was completed on December 9, 10 and 11, 2008.

Again, detailed logs were prepared describing the soil (groundwater and bedrock were not an issue) conditions encountered at each location; representative soil samples were collected at regular intervals throughout the depth of each borehole; and upon completion, the boreholes were backfilled to grade and flagged for future reference.

5.0 LABORATORY TESTING

All samples collected during the field investigation programs described above were returned to EBA's Whitehorse laboratory. The laboratory testing program included natural moisture content determination on all samples collected and particle size distribution testing on select samples for classification purposes.

Along with basic index testing, two samples (borehole W14101171-BH09 at 4.5 m and borehole W14101171-BH20 at 3.0 m) were shipped to ALS Laboratory Group for soluble sulphate testing of the fine grained glaciolacustrine silts found at depth throughout the study area. Results from these tests will be utilized in the selection of cement type for building foundations and underground utilities structures (manholes, vaults, etc.).

6.0 GEOTECHNICAL CONDITIONS

6.1 OFF-SITE ENGINEERING SITES

This section describes the geotechnical and general site conditions encountered along the proposed access road between Mountainview Drive and Range Road; the portion of the Range Road right-of-way at McIntyre Creek which will have to be addressed for water main construction; and in the kettle depression located beside the Mountainview Golf Course (storm water disposal site) as well as conditions anticipated at the two existing water reservoir sites being considered for expansion in order to ensure adequate water volumes for residential use and fire suppression.

6.1.1 Alternate Access Between Mountainview Drive and Range Road

The proposed alternate access road route ties into Mountainview Drive approximately 350 m south of 12th Avenue (close to the YEC sub-station), and runs east up a fairly steep slope onto the same bench that the south end of Tamarack Drive is on and then proceeds down gradient (along a steep slope) to the proposed tie-in with Range Road approximately 120 m south of the existing golf course access road.

Borehole W14101171-BH01 was drilled to a depth of 9.0 m (1 m deeper than the approximate depth of cut through the top of the bench) on the crest overlooking Mountainview Drive. Soil conditions noted at this location were comprised of near surface silty sand, becoming coarser below 2.0 m. Clean, compact gravel and sand was encountered below 4.0 m and extended to the completion depth of 9.0 m.

Borehole W14101171-BH02 was drilled part way down the Range Road side of the bench. Again, silty sand was noted to a depth of 2.0 m with clean compact sand and gravel encountered from 2.0 m to the borehole completion depth of 5.0 m. Two attempts were made to drill past 5.0 m, with refusal on bedrock or a very large boulder experienced on both attempts at this location.

Borehole W14101171-BH03 was drilled along the ditch line on the west side of Range Road. Approximately 0.3 m of poor quality fill (sand and silt) was noted over the organic fill line. Sand with some silt was encountered from 0.3 m to 1.3 m and was underlain with wet (greater than 20% moisture), soft, glaciolacustrine silt. Wet soft soils are likely the result of Range Road acting as a physical barrier for surface runoff running off the east facing slope.

Evidence of erosion potential was noted along the power line overlooking Range Road where deep erosion channels exist under the power line.

Pre-design considerations for the alternate access road construction include:

- The material from the cut at the top of the bench will be suitable as embankment fill on the Mountainview Drive and Range Road sides. It is suggested that the siltier surficial soils be placed throughout the base of the fill areas so that the coarser, cleaner granular soils can be utilized as a suitable, non frost susceptible subgrade material.
- Ditches along the slopes proceeding down to either Mountainview Drive or Range Road should have ditch plugs or some form of energy dissipater to prevent ditch line erosion.
- The recovery section leading onto Range Road may require additional measures. It is EBA's standard recommendation that all paved roadways have a minimum granular structure of 1.7 m in order to minimize potential for frost heave damage. Wet subgrade conditions (as encountered in Borehole W14101171-BH03) may dictate the use of a medium weight non-woven geotextile to act as a barrier between the glaciolacustrine soils and granular fill placed during alternate access road construction.

6.1.2 Water Main Crossing at McIntyre Creek

Conversations with Rick Savage, R.E.T. of Quest Engineering has indicated that the preferred route of the water supply line to the Whistle Bend Subdivision will be an extension of the water line originating at the Valleyview Reservoir and currently running along Range Road to the Northlands Trailer Park area. An extension of this waterline will require crossing McIntyre Creek.

Where Range Road crosses McIntyre Creek, the creek is a narrow and incised with water carried under the roadway in two CSP culverts. The road grades on either side of the creek crossing are relatively steep (9.6% on the south side and 7.3% on the north side of the creek). As well, Range Road crosses the creek on a fairly tight curve (200 m radius – 120 degree curve) and the roadway surface is quite narrow over the culverts.

McIntyre Creek is underlain by ancient alluvial sediments which are interbedded and highly variable (sandy gravels interbedded with glaciolacustrine silt soils) as noted in Boreholes W14101171-BH04; -BH05, -BH06, and BH07.

Options for crossing McIntyre Creek include horizontal directional drilling (HDD); trenchless methods such as pipe ramming or pipe jacking; or an open cut trench. Based on EBA's preliminary review of the site geometry and soil conditions, the following considerations are presented for review:

- HDD may not be the preferred crossing option. A HDD installed pipe (200 to 300 mm diameter) would require a drill path length of well over 50 m based on a radius of curvature of 125 m and a depth of burial below entry/exit point of 2.5 m. Since the slopes on either side of the creek are quite steep, the actual drill path length would have to be significantly longer. As well, the drill path would not only need to navigate through the vertical curve, it would also have to follow a fairly tight horizontal curve. Although these technical challenges can be overcome by experienced contractors, the crossing may be more easily achieved by other methods.
- Given the short crossing length and the relatively shallow depth of burial required, trenchless methods such as pipe jacking or pipe ramming are considered to be appropriate and more cost effective. The entry and exit pits can be located quite close together on opposite sides of the culvert, making the actual pipe ram/jack distance quite manageable. Depending on the exact site conditions (the condition of the existing culverts, the depth to groundwater and the amount of flow through the culverts at the time of construction), it may even be possible to complete the crossing by ramming a carrier pipe a few metres beneath the existing culverts using a large excavator.
- The desire to use HDD or other trenchless methods to complete the McIntyre Creek crossing is commendable in order to minimize the potential for damage to the existing creek bed and fish habitat. However, consideration should be given to the potential benefit of an open cut crossing of the creek, done in conjunction with a replacement of the existing culverts with an open bottom (fish friendly) culvert.

6.1.3 Valleyview Pumphouse

Water to the Whistle Bend Subdivision will likely originate at the Valleyview Pumphouse which may require significant expansion. A file search completed by City of Whitehorse staff discovered that in 1965, the Department of Public Works Canada completed a geotechnical investigation in advance of the Valleyview Reservoir construction as part of the 1965 Whitehorse Water System project. Three boreholes were drilled, 1 in the parking area and 2 within the reservoir site footprint. Each of the boreholes drilled were advanced at least 3 m into competent bedrock (granodiorite). Depths to bedrock varied from 2.5 m just north of the parking area to between 6 m and 7.5 m within the actual reservoir site. Overlying the bedrock was a homogeneous blend of sand, gravel, and silt (TILL) with cobbles and boulders up to 300 mm in size. No groundwater was noted on the logs and is not anticipated at his site.

No as-built information was collected and reviewed as part of this project; however, it is assumed that during the original construction of the reservoir, some blasting of the bedrock surface was necessary to facilitate construction. It is also likely that no over-blasting of the bedrock surface was completed in order to avoid problems caused by blasting against the reservoir structure in anticipation of future expansion. Therefore, expansion of this reservoir site will likely require additional pre-design geotechnical input, such as:

- Volume of overburden to be removed to reach design elevations or bedrock.
- Volume of rock excavation required to reach design elevations (depth to bedrock appears variable).
- Technical input into blasting next to the existing reservoir structure (if required), such as "Smooth-Line" or "Cushion" blasting and commencing the blasting program in the central portion of the expansion area and then working towards the perimeter to minimize potential for damage.
- Safety concerns inherent to "mucking out" the excavation and ensuring that the sidewalls are properly scaled.
- Evaluation of the walls of the excavation to determine whether or not rock bolts may be required to stabilize large slabs or wedges (along joints)
- Geotechnical input into foundation preparation, lateral wall loads and seismic site classification will also be required.

6.1.4 Porter Creek Pumphouse

The second water supply option for the Whistle Bend Subdivision is the expansion of the Porter Creek Pumphouse located in the Kulan Industrial Subdivision. Two boreholes were drilled at the reservoir site (date unknown and it is suspected that the work was initiated by the Department of Public Works Canada). Both boreholes were drilled to refusal in suspected bedrock. Depths to bedrock varied from 4 m towards the front of the reservoir and 8.5 m towards the west side of the reservoir. Soil conditions overlying the bedrock

were variable with silt till and fractured rock overlying the bedrock in Borehole 1 and interbedded till, silty sand, and coarser granular sediments overlying bedrock in Borehole 2. Groundwater was noted at 5 m in testpit 1200125-TP01, located in Lindeman Road ditch line in front of the reservoir site. This testpit was excavated by EBA in 2004 during the Porter Creek Watermain – Phase III project.

As with the Valleyview Reservoir, no as-built information was collected and reviewed as part of this project. Therefore, expansion of this reservoir site will require additional pre-design geotechnical input similar the design aspects listed in the Valleyview Reservoir section above.

6.1.5 Storm Water Retention & Disposal – Kettle Depression Near Golf Course

To assess potential for storm water disposal into an exfiltration pit, a single testpit was excavated in the large kettle depression near the north end of the golf course on March 24, 2009.

Conditions noted in testpit W14101171-TP21 include 0.5 m of seasonally frozen organics (with grass ground cover) overlying wet, soft, silty sand interbedded with organics from 0.5 m to approximately 2.0 m; wet, soft, glaciolacustrine silt from approximately 2.0 m to 4.0 m; and saturated sand from 4.0 m to the base of the testpit excavation at 6.0 m. Groundwater was entering the testpit at approximately 4.0 m. It should be noted that due to sloughing testpit sidewalls, exact depths to groundwater and soil transitions were difficult to determine.

This depression, along with the depression located west of this depression has potential for storm water retention. The soil conditions encountered the depression where testpit W14101171-TP21 was excavated also suggests that storm water disposal in the sand encountered below 4.0 m may also be possible. However, constructing an exfiltration pit may be challenging due to steep slopes limiting equipment access and soft, wet and unstable soil conditions throughout the floor of the depression will result in sloughing soils while excavating the exfiltration pit.

6.2 WHISTLE BEND ON-SITE GEOTECHNICAL CONDITIONS

This section presents terrain hazard assessment information, general site conditions and detailed geotechnical conditions encountered throughout the proposed limits of the Whistle Bend Subdivision.

6.2.1 Terrain Hazard Assessment

The study area is located between the Yukon River on the north and east sides, the Upper Bench portion of Porter Creek to the west and McIntyre Creek to the south characterized by moderately-well drained to well-drained soils and is typically forested with pine, spruce, aspen and some poorly drained areas with willows. Most of the area is gentle gradient terrain. Some low to moderate relief occurs along the escarpment overlooking McIntyre

Creek at southwest corner of the study area; within the kettle depressions at the north end of the study area and on the eolian sand dune in the central southwest portion of the development area. Steep gradient escarpment slopes along the Yukon River at the eastern boundary are bare of vegetation and exhibit some shallow gullying and washing erosion.

Sub-surface materials throughout the study area are characteristic of a deglaciation depositional environment with discontinuous glaciofluvial sands and gravels of variable thickness overlying glaciolacustrine silt at depth and capped by a veneer (< 1 m) to blanket (1-3 m) of eolian sand. Thick glaciolacustrine silts with minor sand and some thin clay beds are exposed along the Yukon River. Eolian sands are discontinuous and thicken in places where low relief dunes were formed. In the central southwest a prominent eolian dune forms a medium-relief, irregular ridge. Subsurface data at the eastern and western extents of the lower bench area indicate an absence of glaciofluvial sands and gravels, where a veneer or blanket of eolian sand directly overlies lacustrine silt. Much of the central area probably has a similar stratigraphy, with sandy gravels appearing and thickening in the northwest corner of the area (section of Range Road close to the intersection with Hickory Street and Wann Road).

Since most of the slopes within the central portion of the proposed development area are gentle with minimal relief, there is minimal terrain risk. However, the glaciolacustrine escarpment slopes overlooking the Yukon River are very susceptible to mass movement processes such as debris flows, toppling, mud flows and other landslide mechanisms. Active slope movement processes are common on glaciolacustrine escarpment slopes, which make them very sensitive to any development which may alter the drainage regime. For instance, erosional gullies and shallow landslides were observed on the steep escarpment along the Yukon River (southeast site boundary) and a landslide into the Yukon River was noted on a forested glaciolacustrine slope near a golf course fairway in the northeast.

6.2.2 Whistle Bend Geotechnical Conditions

On the accompanying site plan (Figure 1), the locations of all testholes (from the recent evaluation and previously completed projects) used for this geotechnical evaluation are presented and detailed logs with basic soil classification laboratory test data for each testhole are presented in Appendix B on this report.

Soil conditions, proceeding from the slope defining the east edge of the upper bench to the Yukon River can be summarized as:

- Soil conditions throughout the Porter Creek Upper Bench, along Larch Street., Cedar Crescent, Balsam Crescent and Evergreen Crescent, are fairly consistent with medium to fine grained silty sand overlying coarse glaciofluvial gravel. The contact between the gravel underlying the Upper Bench area and the soils considered typical of the Whistle Bend area can be observed within exposures on the west side of Range Road approximately 400 m south of the Wann Road intersection and along the Porter Creek Transfer Pipeline route 200 m east of the Larch Street – Oak Street intersection.

Borehole log 11731-BH01 defines the properties of the typical glaciofluvial gravels underlying the Upper Bench area. The slope down to the Lower Bench area east of Balsam and Cedar Crescents is quite broad and steep. Surface water being carried down gradient (rain and snow melt) appears to be responsible for increased moisture contents in the glaciolacustrine silt soils along the west side of the Porter Creek Lagoon Access Road (immediately south of the Transfer Pipeline route where thick willow shrubbery covers much of the area).

- Proceeding in an easterly direction towards the Yukon River, varying thicknesses of eolian sand overlying glaciolacustrine silt soils is common at all locations where testholes were advanced. Generally, less than one metre of sand exists over the underlying glaciolacustrine soils. However, in specific locations, significant thicknesses of sand have been noted (previously completed boreholes 12025-BH02; 11731-BH07; 11731-BH09; 11731-BH10 and 11731-BH11 as well as recently drilled boreholes W14101171-BH09, -BH11, -BH13, -BH15 and –BH20) where boreholes were located on eolian sand landforms.
- Soil conditions along the bank overlooking the Yukon River are a little more complex. The bank along the east side of the lower bench is typical of most of the area with sand overlying glaciolacustrine silt (around the golf course and the bank overlooking McIntyre Creek. The banks overlooking the portion of the Yukon River which defines the north side of the site is comprised of granular soils. The soil stratigraphy is defined by Borehole 12025-BH05 where granular soils were noted to below 20 m. As mentioned in the Terrain Analysis section of this report, air photo interpretation has delineated kettle features along the north side of the site as well, which are commonly underlain by coarse granular sediments. This glaciofluvial soil unit has been noted on both sides of the river during the geotechnical work completed during the 1995 Whitehorse Sewage Treatment Facility geotechnical evaluation as well as the air photo interpretation work completed for this project.

7.0 RECOMMENDATIONS

7.1 WHISTLE BEND SUBDIVISION DEVELOPMENT RECOMENDATIONS

Aspects of subdivision development and construction addressed in the following sections include roadway structure design and construction; underground utilities installation, thermal analysis considerations; excavation and material reuse.

7.1.1 Pavement Structure Design – Whistle Bend; Alternate Access & Range Road Upgrades

Previous pavement structure design work was completed by EBA during the Rangeway Road Reconstruction project in 1995, when EBA was contracted by the City of Whitehorse in 1997 to review the existing Rangeway Road pavement structure and evaluate the roadway for increased bus traffic. California Bearing Ratio (CBR) testing was completed on typical sub-base and basecourse gravels and based on anticipated bus traffic, it was determined that

for a BST surfaced roadway, 150 mm of basecourse gravel over 600 mm of sub-base gravel was adequate over silty subgrade soils, while 150 mm of basecourse gravel over 300 mm of sub-base gravel was adequate for the sand subgrade soil sections. However, it must be stated that the recommendations provided were developed for a BST surfaced roadway and the design does not address the potential for seasonal frost heave damage. Under paved roadways with concrete sidewalks and curb & gutter, EBA recommends a minimum of 1.7 m of non-frost susceptible granular structure to not only ensure adequate pavement structure but also to minimize the potential for frost heave damage and subgrade softening during spring thaw. This recommendation applies to all roadway design and construction associated with the Whistle Bend development, including upgrades made to Range Road and the construction of the new alternate access road to Mountainview Drive, as well as the streets throughout the Whistle Bend Subdivision. To summarize, the minimum roadway structure must include 75 mm of hot mix asphalt (HMA), 150 mm of basecourse gravel (20 mm crushed gravel) and at least 300 mm of sub-base gravel (50 mm crushed gravel is preferred but 100 mm pit run sub-base gravel is acceptable). The actual thickness of gravel placed as subgrade/sub-base gravel will be dependant upon what is necessary to ensure 1.7 m of non-frost susceptible roadway structure.

Specific to pavement structure design within the Whistle Bend Subdivision, the testholes drilled and have identified two predominant subgrade soil types. During roadway construction, either glaciolacustrine silt or uniformly graded eolian sand will be encountered. The glaciolacustrine silts are considered to be prone to softening in a moist to wet state and are very frost susceptible. The eolian sand found overlying much of the site is generally damp to dry and very well drained. The sand is not considered a frost heave threat but past experience on projects with similar subgrade soils has shown that roadway construction on a uniform sand subgrade can be challenging.

Therefore, some portions of the development area will likely require subcuts of up to 1.7 m (glaciolacustrine silt subgrade sections), while areas with more than 1.7 m of sand overlying the silts will require very minimal subcuts. Figure 2 presents approximate areas which have greater and less than 1.5 m of sand over the frost susceptible silt for reference.

Imported granular materials used on this project must comply with the City Servicing Standards Manual. The gradation specifications for sub-base and basecourse gravels are presented in Table 1, on the next page.

TABLE 1 RECOMMENDED GRANULAR MATERIALS SPECIFICATIONS			
50 mm CRUSHED SUB-BASE GRAVEL		20 mm CRUSHED BASECOURSE GRAVEL	
SIEVE SIZE (mm)	% PASSING BY MASS	SIEVE SIZE (mm)	% PASSING BY MASS
50.000	100		
25.000	60 – 100	20.000	100
12.500	40 - 90	12.500	64 - 100
5.000	20 - 65	5.000	36 - 72
1.250	9 –35	1.250	12 - 42
0.315	5 - 23	0.315	4 - 22
0.080	2 - 10	0.080	3 - 8

If alternate materials are being considered (such as 200 mm Gran E or 100 mm Gran B sub-base gravels, which may be readily available for use), EBA will conduct particle size analysis testing and then provide an opinion regarding acceptability for use.

Compaction specifications for the prepared subgrade and the materials placed as sub-base, and basecourse are as follows:

- The subgrade should be shaped, graded, moisture conditioned and compacted to 98% of maximum dry density using standard effort (ASTM D698). It is critical that all areas of instability be repaired (additional subcut and backfill with coarse granular materials) prior to placing the actual sub-base course.
- A prepared non-frost susceptible sub-base course (50 mm crushed sub-base gravel – two lifts which are 150 mm in compacted thickness), is to be placed, moisture conditioned to facilitate the compaction process, and compacted to at least 98% of maximum dry density using standard effort (ASTM D698).
- Basecourse (20 mm crushed gravel – 150 mm in compacted thickness) is to be placed, moisture conditioned and also compacted to at least 98% of maximum dry density using standard effort (ASTM D698). If the total granular structure is comprised of basecourse gravel, it would be EBA's preference that the basecourse be placed in 2 lifts.

7.1.2 Underground Utilities Installation

Underground utilities installation, including water & sewer lines, as well as services to individual lots or structures, storm sewer system construction and shallow electrical utilities (power and communications lines) can all be constructed using conventional construction methods (tracked excavator equipped with a clean-up bucket will likely be acceptable).

Excavation of utility trenches must conform to the Yukon Occupational Health & Safety Regulations. The predominant soil profile will be dry sand over moist to wet glaciolacustrine silt. Trench side slopes may have to be cut to 1.5:1 (horizontal:vertical) in

areas where the dry uniformly graded sands cause significant sloughing into the utility trenches.

All sand excavated from utility trenches will be acceptable for reuse as pipe bedding or trench backfill. The glaciolacustrine silt may have to be wasted if it is too wet to compact, otherwise it can be used as backfill over the pipe bedding but not within 1.7 m of final roadway elevations.

It is recommended that a Class "B" pipe bedding configuration (as presented in the Whitehorse City Servicing Standards Manual) be specified for this site. This insures proper protection of the buried utility lines during backfill. Bedding may be imported bedding sand or bedding stone. Imported bedding sand and stone should conform to the gradation specifications presented in Table 2 and should be at least 150 mm thick below the pipe and 300 mm thick above the pipe.

TABLE 2 RECOMMENDED PIPE BEDDING MATERIALS SPECIFICATIONS

BEDDING SAND		25 mm BEDDING STONE	
SIEVE SIZE (mm)	% PASSING BY MASS	SIEVE SIZE (mm)	% PASSING BY MASS
10.000	100	25.000	100
5.000	80 – 100	20.000	70 - 100
2.000	55 - 100	12.500	55 - 100
0.630	25 - 65	10.000	30 - 80
0.250	10 – 40	5.000	0 - 40
0.080	2 - 15	2.000	0 - 10

It is EBA's opinion that the sand found throughout the Whistle Bend site is also acceptable for use as pipe bedding. During construction, periodic particle size analysis testing should be performed to ensure on-going acceptability.

7.1.3 Storm Management Plan

The AECOM Stormwater Management Plan submitted to the City of Whitehorse in July, 2009 has been reviewed by EBA and is considered appropriate for this subdivision development. Positive comments presented during the EBA review include:

- All exfiltration pit locations are situated off roadways, minimizing the potential for subgrade soil saturation which can result in an increase of frost heave potential along streets;
- The conceptual infiltration pit design proposed for use is similar to previous EBA submissions. Comments included that the design hydraulic conductivity may have to be adjusted based on actual soil conditions and therefore, the sizing and configuration of the pits may have to be adjusted based on actual conditions;

- On some of the commercial, apartment and condominium sites, the actual location of the infiltration pits may require adjustment to take advantage of varying thicknesses of sand over the glaciolacustrine silts,
- The proposed use of the kettle depressions for future phases of development is also considered acceptable. However, additional geotechnical work may be required at the final design stage;
- Overall, the use of various strategies such as bio swales, rain gardens and infiltration pits is appropriate for a subdivision which has an elaborate trail network and significant green space areas.

7.1.4 Concrete

It is recommended that all concrete utilized for sidewalks, curb & gutter, exterior pads and aprons be designed, mixed, and placed in accordance with the Canadian Standards Association standard CAN/CSA-A23.1-04. According to this standard, concrete should be designed to at least satisfy minimum environmental durability requirements as defined by its exposure class, which in this case would be F-2 (concrete in an unsaturated condition but exposed to cycles of freezing and thawing. It is recommended that the following properties be specified:

- Maximum water cement ratio 0.5,
- Minimum specified compressive strength of 30 MPa (as per City of Whitehorse Servicing Standards Manual),
- 5% to 7% entrained air,
- Nominal aggregate size of 20 mm is recommended.
- Concrete placed as sidewalk or curb & gutter are typically placed over good quality basecourse gravels therefore, Type GU (previously designated as Normal Type 10) cement is acceptable for use during surface works construction. Concrete placed at depth, which may be in contact with the glaciolacustrine soils must address soluble sulphate attack. Tests previously completed (4 tests) on glaciolacustrine silt soils in the vicinity of the Transfer Pipeline determined that the levels of soluble sulphates ranged from moderate to severe. Two additional tests completed during the current geotechnical evaluation suggested levels were mild but positive to negligible. This is not an unusual occurrence as soluble sulphate concentrations in soils are believed to associated with fairly dry climates causing the sulphates to wick up from the lower salt bearing soil strata (in this case the glaciolacustrine soils). On sites where levels can be as high as moderate to severe, the use of Type HS – High Sulphate Resistant (formally known as Type 50) cement is usually recommended. However, since the recent and historical results are quite variable, it is suggested that all concrete (other than the surface works concrete discussed above) produced with 25% flyash replacement (by weight of cement) to mitigate the potential for sulphate attack and damage. This

recommendation applies to building foundations, manholes, and all other concrete structures which may be in contact with the glaciolacustrine soils.

- In addition to the above requirements, CAN/CSA-A23.1-04 also provides recommendations for hot and cold weather concrete placement, which must be adhered to. These include protecting freshly placed concrete from extreme heat or freezing temperatures.

7.1.5 Geothermal Analyses

A thermal analysis was completed for the Porter Creek Transfer Pipeline in 1995. The analysis was completed utilizing EBA's proprietary finite element program GEOTHERM. For the soil conditions along the Transfer Pipeline (which are considered typical of the whole Whistle Bend area) a pipe burial depth of 3.9 m was recommended. The recommendation was based on seasonal frost depth determinations plus an assumed pipe diameter to ensure that the pipe is entirely below seasonal frost penetration depths.

EBA and the City of Whitehorse have been monitoring seasonal frost penetration at the Takhini Firehall (area where soil conditions are consistent with the Lower Bench area – ie. sand over silt) and based on the data collected, it was recommended that a 3.6 m minimum depth of burial for uninsulated service lines be utilized during the Takhini West-South Reconstruction project.

7.1.6 Foundations

Residential structure foundations must be constructed in accordance to the National Building Code of Canada, 2005. Generally, residential structures will be supported by conventional foundation systems, (strip & spread footings or monolithic thickened slab-on-grade foundations). This is considered acceptable for use throughout the Whistle Bend Subdivision. All commercial structures as well as apartments and condominium structures should have site-specific geotechnical evaluations completed prior to construction.

The two main concerns for foundations in the Whistle Bend Subdivision will be the potential construction of footings on fine grained, frost susceptible soils (houses with full basements) and the control of roof runoff and surface water in subdivisions with high density housing. To mitigate the potential for frost heave damage to foundations, the use of perimeter insulation may be required in some instances, but most importantly, the control of roof runoff and surface water must be considered (perimeter drainage systems may be required in some instances).

7.2 RECOMENDATIONS FOR FINAL DESIGN GEOTECHNICAL SERVICES

During the final design phases of this project, it is recommended that EBA provide the following services:

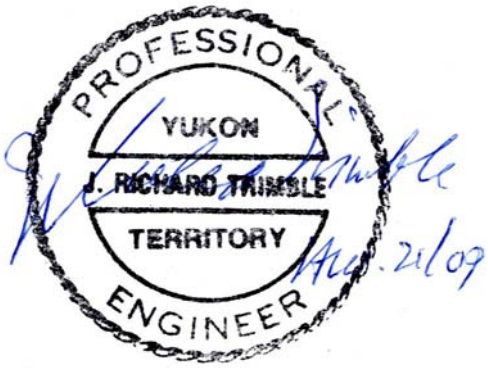
- Once the roadways throughout the initial phases of development have been cleared, it is recommended that an additional series of shallow testpits should be excavated to establish subcut depths and volumes;
- At each of the infiltration pit locations, a testpit can also be excavated to establish preferred locations, actual hydraulic conductivity of the accepting soils, and adjustments to the size of the infiltration pit.
- If considered appropriate, additional soluble sulphate testing can also be completed to establish the most appropriate cement type. However, as mentioned above, it may preferable to specify the use of flyash, which has become common on LEED projects.

8.0 LIMITATIONS AND CLOSURE

This report and its contents are intended for the sole use of AECOM and their agents. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than AECOM or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in EBA's Services Agreement and in the General Conditions provided in Appendix A of this report.

We trust this report satisfies your requirements at this time. Please contact the undersigned if we can provide further assistance.

Sincerely;
EBA Engineering Consultants Ltd.



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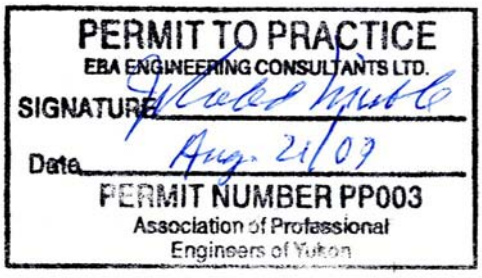


FIGURES

LEGEND

- BOREHOLE (SHOWN WHITE) RECENTLY COMPLETED (DEC. 2008)
- *BOREHOLE (SHOWN WHITE) PREVIOUSLY COMPLETED*
- TESTPIT (SHOWN WHITE)

0 500

Scale: 1: 15 000 (metres)

CLIENT

AECOM

GEOTECHNICAL EVALUATION
WHISTLE BEND SUBDIVISION - WHITEHORSE, YT

SITE PLAN SHOWING TESTHOLE LOCATIONS

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W14101171	JSB	MCP	0

OFFICE: WHSE

DATE: March 26, 2009

Figure 1

LEGEND

- BOREHOLE (SHOWN WHITE) RECENTLY COMPLETED (DEC. 2008)
- *BOREHOLE (SHOWN WHITE) PREVIOUSLY COMPLETED*
- TESTPIT (SHOWN WHITE)
- GREATER THAN 1.5 m OF EOLIAN SAND OVER GLACIOLACUSTRINE SILT.

REMAINDER OF SITE HAS EOLIAN SAND VENEER OVERLYING GLACIOLACUSTRINE FINE GRAINED SOILS.

0 500

Scale: 1: 15 000 (metres)

CLIENT

AECOM

GEOTECHNICAL EVALUATION
WHISTLE BEND SUBDIVISION - WHITEHORSE, YT

SURFICIAL SOIL DELINEATION

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W14101171	JSB	MCP	0

OFFICE: WHSE

DATE: March 26, 2009

Figure 2

APPENDIX A

APPENDIX A GEOTECHNICAL TERMS AND CONDITIONS

GEOTECHNICAL REPORT – GENERAL CONDITIONS

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 SURFACE WATER AND GROUNDWATER CONDITIONS

Surface and groundwater conditions mentioned in this report are those observed at the times recorded in the report. These conditions vary with geological detail between observation sites; annual, seasonal and special meteorologic conditions; and with development activity. Interpretation of water conditions from observations and records is judgemental and constitutes an evaluation of circumstances as influenced by geology, meteorology and development activity. Deviations from these observations may occur during the course of development activities.

8.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

9.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

10.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

11.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

12.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

13.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

14.0 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

APPENDIX B

APPENDIX B TESTHOLE LOGS AND LABORATORY DATA – OFF-SITE ENGINEERING

WHISTLE BEND SUBDIVISION

Testhole Logs From Previously Completed Projects

PROJECT PORTER CREEK LAGOON

TESTHOLE No. 1

SURFACE ELEVATION 2216

JOB No. E-1022

Depth ft.	SOIL DESCRIPTION
	PEAT - fibrous
2	SILT - medium brown - tr. to some clay - some oxides - seasonal frost to 3½'
4	
	- non plastic - dry to moist
6	- thinly laminated
8	
10	
12	
14	
	- thinly bedded with layers of silty clay - moist - soft
16	
18	
20	
	- wet - soft - non plastic
22	
24	
26	
	CLAY - medium grey - low to med. plastic - soft - moist to wet - thin sand lenses at 26'
28	
30	
32	END OF HOLE

Water Content % ●

10 20 30 40

Compressive Strength tsf.

1 2 3 4 5

Pocket Pentrometer △

Completion Depth 31½ Date 27-02-75

Depth to Water in Boring

Page 1 of 1

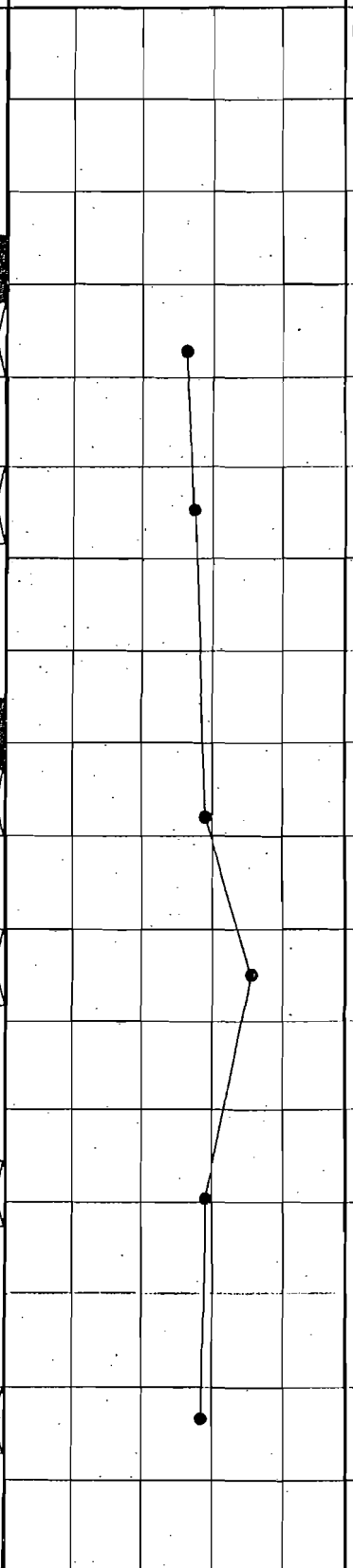
10 20 30 40 50

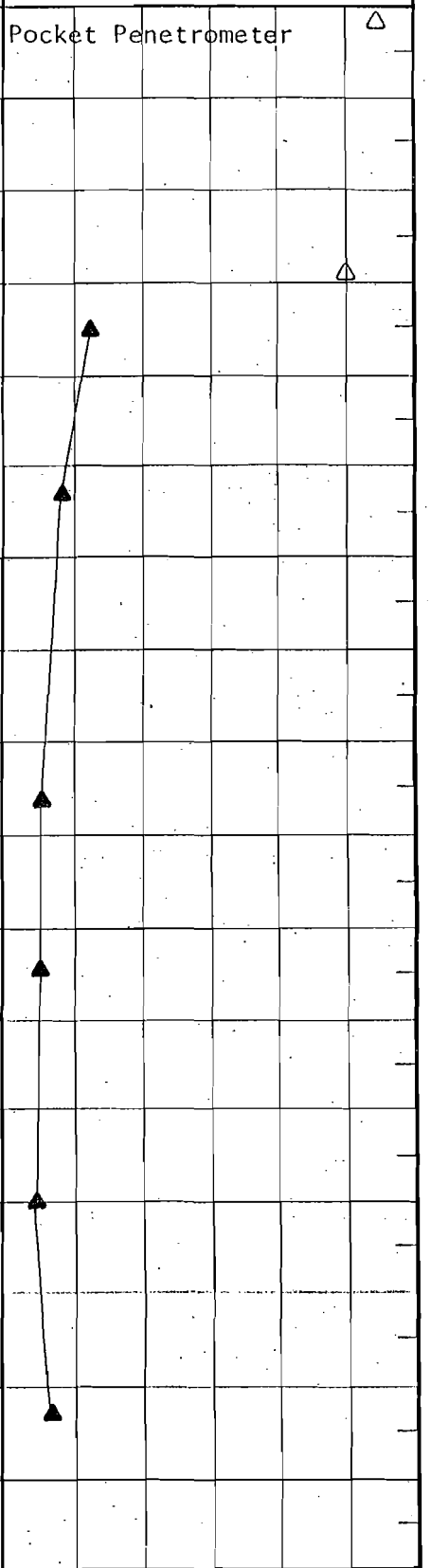
Penetration Resistance N ▲

Dwg. No.

PROJECT	PORTER CREEK LAGOON	TESTHOLE No.	2
SURFACE ELEVATION	2218	JOB No.	E-1022

Depth ft.	SOIL DESCRIPTION
	PEAT - fibrous
	SAND - medium to light brown
2	- silty
	- fine grained
	- uniform, dry
4	SILT - med. brown
	- trace of clay
	- trace of oxides
6	- seasonal frost to 3½'
	- dry to moist
	- thinly laminated
8	- oxide staining on laminations
	- moist
10	
	- thinly bedded with silty clay
12	
14	
16	
	- soft
18	
20	
	- some oxides
22	
	- med. grey
24	
26	
28	
	CLAY - med. grey
	- low plastic
30	- moist to wet
	- soft
32	END OF HOLE





Completion Depth 31½ Date 27-02-75

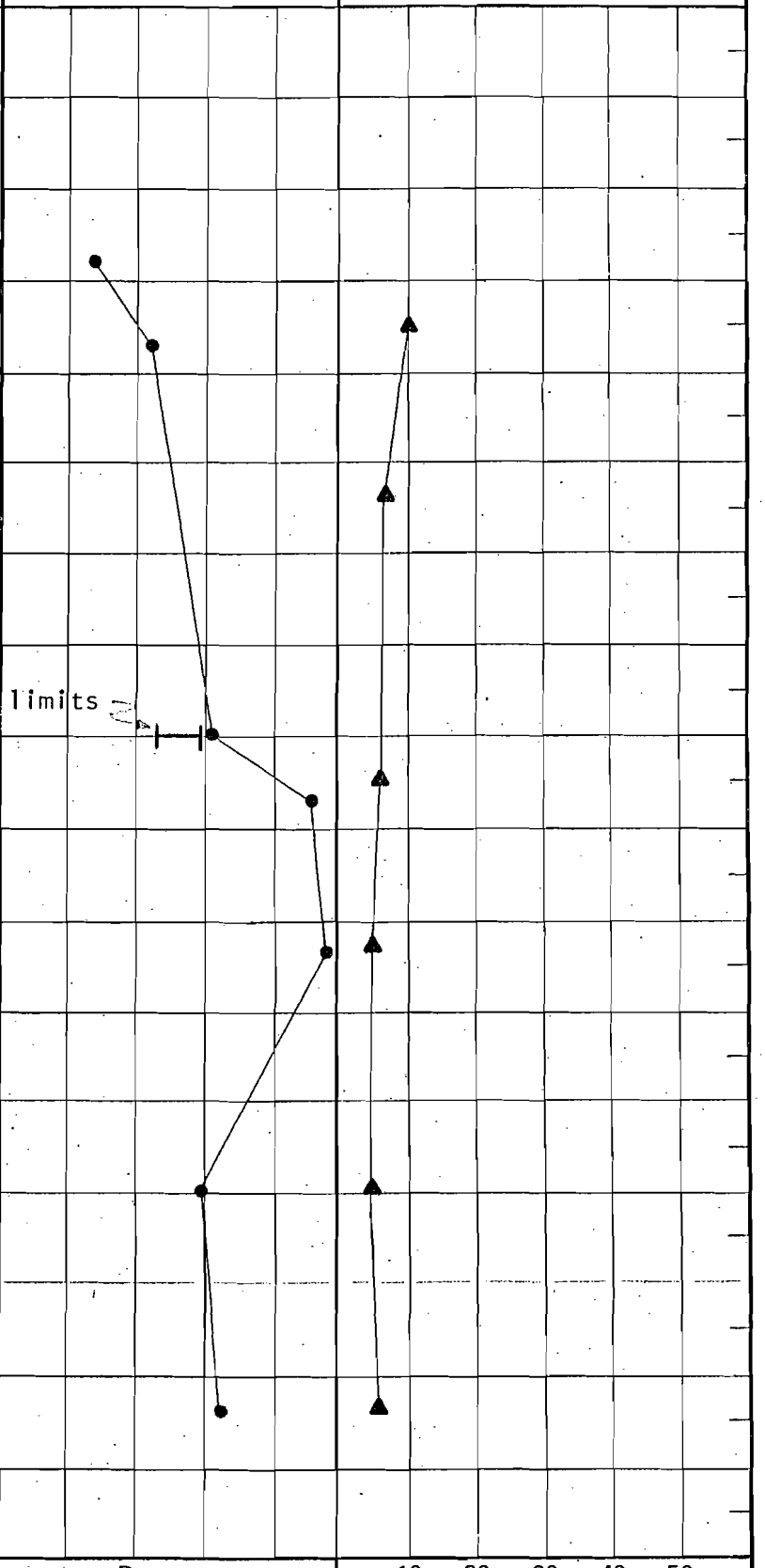
Depth to Water in Boring

Page 1 of 1

Dwg. No.

PROJECT	PORTER CREEK LAGOON	TESTHOLE No.	3
SURFACE ELEVATION	2219	JOB No.	E-1022

Depth ft.	SOIL DESCRIPTION
	PEAT - fibrous
2	SAND - medium brown - silty - fine grained, uniform - dry
4	
	SILT - med. brown - non plastic - thinly laminated - dry to moist - some oxides
6	
8	- seasonal frost to 4'
10	
12	
14	
16	
18	- thinly bedded with layers of silty clay low to med. plastic
20	
22	- soft
24	
26	
28	
	CLAY - med. grey, silty - low to medium plastic - moist to wet - soft
30	
32	END OF HOLE



Completion Depth 31½ Date 27-02-75

Depth to Water in Boring

Page 1 of 1

Dwg. No.

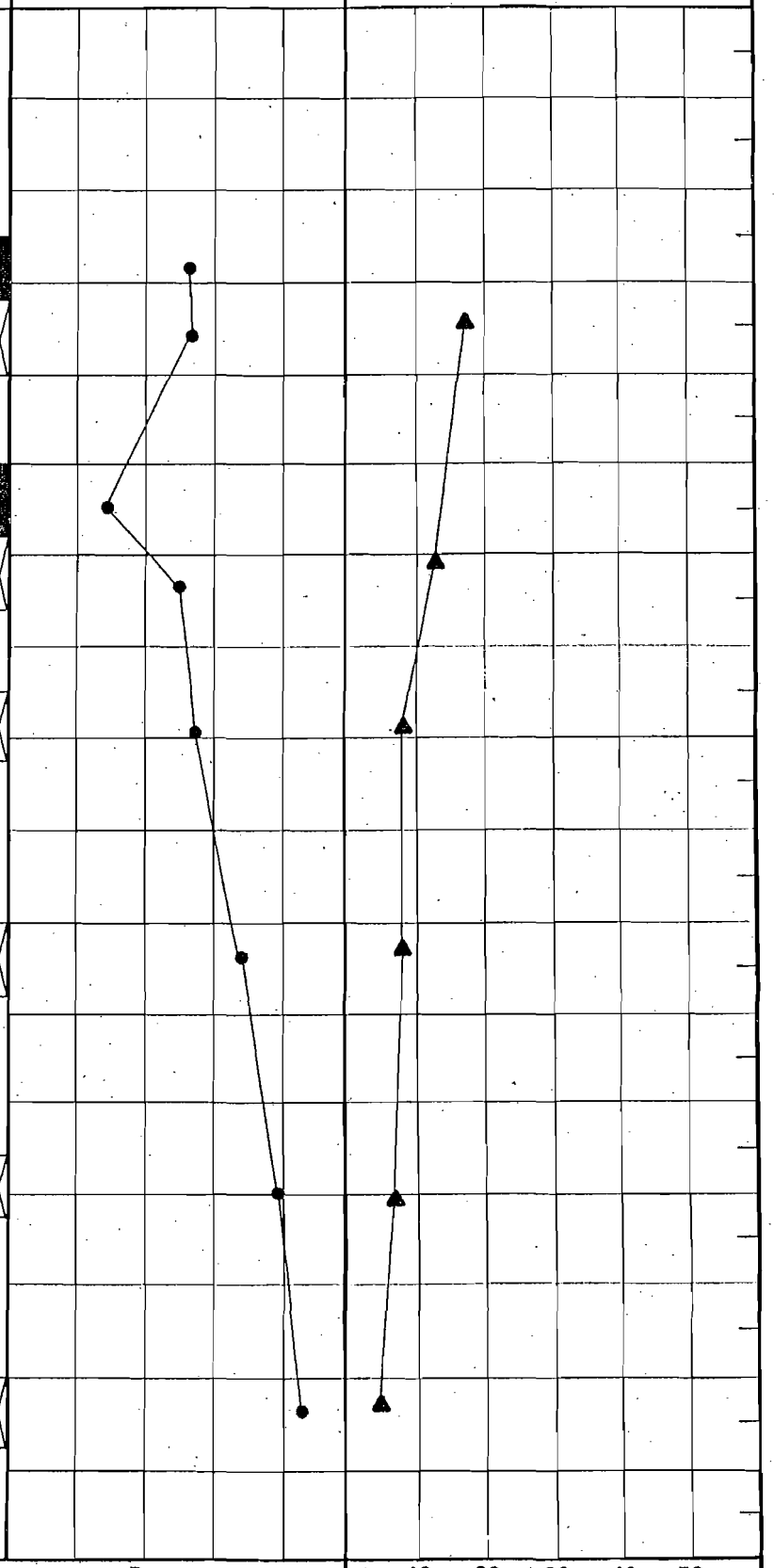
PROJECT PORTER EEK LAGOON

TESTHOLE No. 4

SURFACE ELEVATION 2214

JOB No. E-1022

Depth ft.	SOIL DESCRIPTION
	PEAT - fibrous
2	SILT - med. brown - non plastic - some oxides - dry to moist - seasonal frost to 4½ - some clay - thinly laminated
4	
6	
8	
10	
12	
14	
16	
18	
20	
22	
24	- clayey
26	
28	CLAY - medium grey - silty - low to med. plastic - moist to wet - soft
30	
32	END OF HOLE



Completion Depth 31½

Date 27-02-75

Depth to Water in Boring

Page 1 of 1

Dwg. No.

PORTER CREEK SEWAGE LAGOON	STANLEY ASSOCIATES	TEST PIT NO: 4904-01
PROPOSED SLUDGE LAGOON AREA	CASE 670 RUBBER TIRED BACKHOE	PROJECT NO: 0201-4904
	UTM ZONE: 8 N6738800 E493000	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY ▯▯ SHELBY TUBE

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS(OL)–silty, fibrous, black
					SAND(SP)–trace of silt, medium grained, uniform, moist, loose (est.), dark orangey brown
1.0					SILT(ML)–clayey, trace of fine sand, horizontal and parallel laminae, 2 mm thick, moist, dense, medium plastic, light olive
2.0					END OF TEST PIT 2.4 m
3.0					WATER TABLE NOT ENCOUNTERED
4.0					
5.0					
6.0					

PLASTIC M.C. LIQUID (10 20 30 40)

■ PERCENT GRAVEL ■ (20 40 60 80)

● PERCENT SAND ● (20 40 60 80)

▲ PERCENT SILT OR FINES ▲ (20 40 60 80)

◆ PERCENT CLAY ◆ (20 40 60 80)

ELEVATION(m): 0.0, −2.0, −4.0, −6.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP	COMPLETION DEPTH: 2.3 m
	REVIEWED BY: JRT	COMPLETE: 88-09-07
	Fig. No: 4904-01	Page 1 of 1

08/07/15 08:24AM (YUKON-T6)

PORTER CREEK SEWAGE LAGOON	STANLEY ASSOCIATES	TEST PIT NO: 4904-02
PROPOSED SLUDGE LAGOON AREA	CASE 670 RUBBER TIRED BACKHOE	PROJECT NO: 0201-4904
	UTM ZONE: 8 N6738800 E493000	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY ▯ SHELBY TUBE

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS(OL)–silty, fibrous with rootlets throughout, black
					SAND(SP)–trace of silt, medium grained, uniform, moist, loose (est.), dark orangey brown
1.0					SILT(ML)–clayey, trace of fine sand, horizontal and parallel laminae, 2 mm thick, moist, dense, medium plastic, light olive
2.0					
					END OF TEST PIT 2.5 m
3.0					WATER TABLE NOT ENCOUNTERED
4.0					
5.0					
6.0					

PLASTIC M.C. LIQUID
10 20 30 40

■ PERCENT GRAVEL ■
20 40 60 80

● PERCENT SAND ●
20 40 60 80

▲ PERCENT SILT OR FINES ▲
20 40 60 80

◆ PERCENT CLAY ◆
20 40 60 80

ELEVATION(m)
0.0
-2.0
-4.0
-6.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP	COMPLETION DEPTH: 2.5 m
	REVIEWED BY: JRT	COMPLETE: 88-09-07
	Fig. No: 4904-02	Page 1 of 1

08/07/15 08:24AM (YUKON-T6)

PORTER CREEK SEWAGE LAGOON	STANLEY ASSOCIATES	TEST PIT NO: 4904-03
PROPOSED SLUDGE LAGOON AREA	CASE 670 RUBBER TIRED BACKHOE	PROJECT NO: 0201-4904
	UTM ZONE: 8 N6738800 E493000	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY ▯▯ SHELBY TUBE

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS(OL)–silty, fibrous, rootlets throughout, black
					SILT(ML)–trace of fine sand, trace of volcanic ash on top of unit, damp, non plastic, light brown
1.0					SAND(SP)–trace of silt, medium grained, uniform, moist, loose (est.), dark orangey brown
					SILT(ML)–clayey, trace of fine sand, horizontal and parallel laminae, 2 mm thick, moist, dense, medium plastic, light olive
2.0					
					END OF TEST PIT 2.5 m
3.0					WATER TABLE NOT ENCOUNTERED
4.0					
5.0					
6.0					

PLASTIC M.C. LIQUID
10 20 30 40

■ PERCENT GRAVEL ■
20 40 60 80

● PERCENT SAND ●
20 40 60 80

▲ PERCENT SILT OR FINES ▲
20 40 60 80

◆ PERCENT CLAY ◆
20 40 60 80

ELEVATION(m): 0.0, -2.0, -4.0, -6.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP	COMPLETION DEPTH: 2.5 m
	REVIEWED BY: JRT	COMPLETE: 88-09-07
	Fig. No: 4904-03	Page 1 of 1

08/07/15 08:24AM (YUKON-T6)

PORTER CREEK TRANSFER PIPELINE	CLIENT: STANLEY ASSOCIATES ENGINEERING	BOREHOLE NO: 12025-BH01
WHITEHORSE SEWAGE TREATMENT FACILITY	DRILL: CME-75 C/W SOLID SHAFT AUGERS	PROJECT NO: 0201-95-12025
WHITEHORSE, YUKON	UTM ZONE: 8 N6738330 E493070	ELEVATION: 675 m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

DCPT (blows/300 mm): 6 12 18 24

PLASTIC M.C. LIQUID: 10 20 30 40

PERCENT GRAVEL: 20 40 60 80

PERCENT SAND: 20 40 60 80

PERCENT SILT OR FINES: 20 40 60 80

PERCENT CLAY: 20 40 60 80

Depth(m)	SAMPLE TYPE	SPT(N)	SOIL DESCRIPTION	ELEVATION(m)
0.0			SILT – some clay, trace of sand; non-plastic; firm; moist; light grey	675.0
1.0			SILT AND CLAY – low plastic; firm; moist; light grey	
2.0			– moisture content increases with depth	673.0
3.0			– below 3.0 m; moist to wet; medium grey	
4.0				671.0
5.0			END OF BOREHOLE @ 4.5 m – no water table encountered – borehole located at approximately Station 10+450 –Elevation is estimated	
6.0				669.0
7.0				
8.0				667.0

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LOGGED BY: JSB	COMPLETION DEPTH: 4.5 m
REVIEWED BY: CRH	COMPLETE: 19/10/95
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08/07/15 08:37AM (YUKON-7)

PORTER CREEK TRANSFER PIPELINE	CLIENT: STANLEY ASSOCIATES ENGINEERING	BOREHOLE NO: 12025-BH02
WHITEHORSE SEWAGE TREATMENT FACILITY	DRILL: CME-75 C/W SOLID SHAFT AUGERS	PROJECT NO: 0201-95-12025
WHITEHORSE, YUKON	UTM ZONE: 8 N6738610 E493390	ELEVATION: 679 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▥ CRREL BARREL

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0						SAND – trace of silt; fine grained; loose; damp; medium brown
1.0						
2.0	■	1				– colour changes to a medium grey below 1.5 m
3.0	■	2				– silt content increases to some below 2.5 m
4.0						SILT – clayey; low plastic; firm; moist; medium grey
5.0	■	3				
6.0	■	4				– becomes moist to wet; more clayey with depth
7.0						
8.0	■	5				END OF BOREHOLE @ 7.8 m – no water encountered – sloughing from start of drilling to 4.0 m – Borehole located at approximately Station 10+850 – elevation is estimated
9.0						
10.0						

■ SPT PENETRATION ■ 40 80 120 160

PLASTIC M.C. LIQUID 20 40 60 80

■ PERCENT GRAVEL ■ 20 40 60 80

● PERCENT SAND ● 20 40 60 80

▲ PERCENT SILT OR FINES ▲ 20 40 60 80

◆ PERCENT CLAY ◆ 20 40 60 80

Depth(ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0, 24.0, 26.0, 28.0, 30.0, 32.0, 34.0

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LOGGED BY: JSB	COMPLETION DEPTH: 7.8 m
REVIEWED BY: CRH	COMPLETE: 19/10/95
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08/07/15 08:37AM (YUKON10)

PORTER CREEK TRANSFER PIPELINE	CLIENT: STANLEY ASSOCIATES ENGINEERING	BOREHOLE NO: 12025-BH03
WHITEHORSE SEWAGE TREATMENT FACILITY	DRILL: CME-75 C/W SOLID SHAFT AUGERS	PROJECT NO: 0201-95-12025
WHITEHORSE, YUKON	UTM ZONE: 8 N6938720 E493590	ELEVATION: 675 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▥ CRREL BARREL

Depth(m)	SAMPLE TYPE	SPT(N)	SOIL DESCRIPTION	ELEVATION(m)
0.0			SAND – trace of silt; medium grained; soft; damp to moist; light reddish brown	675.0
1.0			SILT – trace to some clay, trace of sand; non-plastic; fine grained; soft; damp; light grey	
	■		– clay content increases with depth	
2.0				673.0
			– becomes moist below 2.6 m	
3.0	■		– some clay to clayey by 3.0 m	
4.0			SILT AND CLAY – low plastic; moist to wet; firm; olive grey	671.0
	■		– wet by 4.5 m	
5.0			END OF BOREHOLE @ 4.6 m – no water encountered – little to no sloughing – Borehole located at approximately Station 11+100 – Elevation is estimated	
6.0				669.0
7.0				
8.0				667.0
9.0				

■ STANDARD PENETRATION (N) ■ 20 40 60 80
◆ DCPT ◆ 10 20 30 40
PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80
● PERCENT SAND ● 20 40 60 80
▲ PERCENT SILT OR FINES ▲ 20 40 60 80
◆ PERCENT CLAY ◆ 20 40 60 80

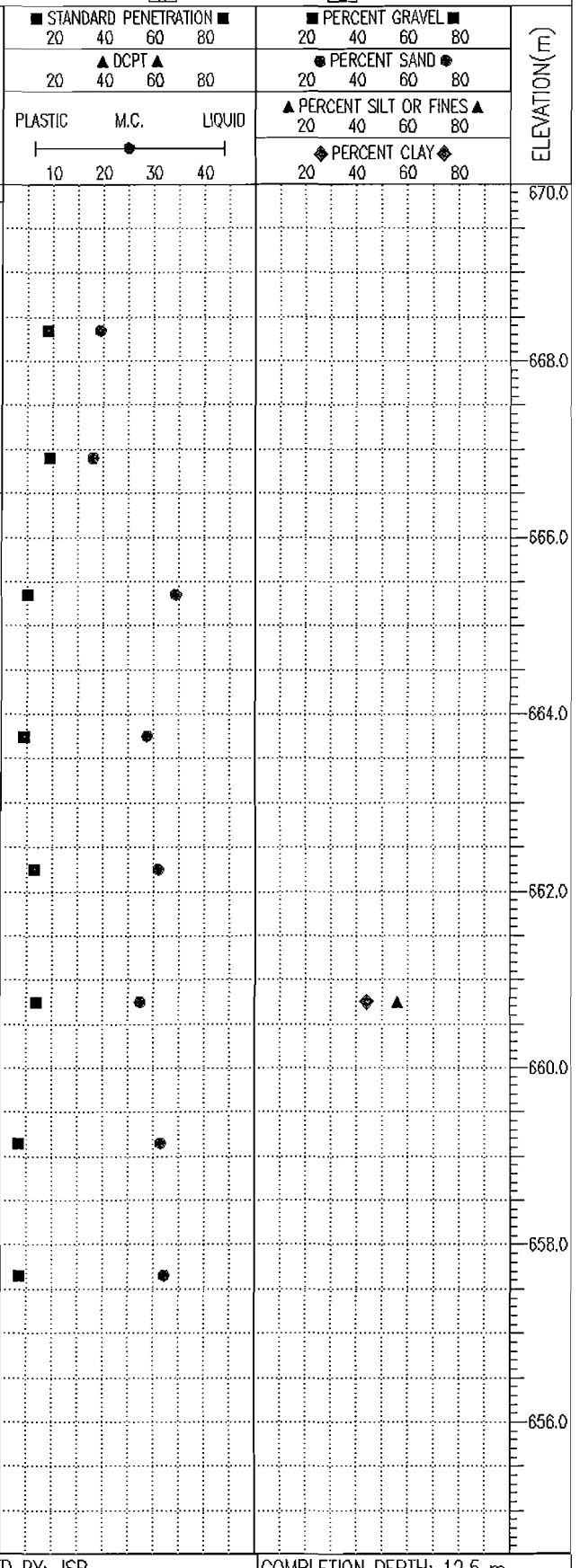
EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: JSB
	REVIEWED BY: CRH
	COMPLETION DEPTH: 4.6 m
	COMPLETE: 19/10/95
	Page 1 of 1

08/07/15 08:38AM (YUKON-8)

PORTER CREEK TRANSFER PIPELINE	CLIENT: STANLEY ASSOCIATES ENGINEERING	BOREHOLE NO: 12025-BH04
WHITEHORSE SEWAGE TREATMENT FACILITY	DRILL: CME-75 C/W HOLLOW STEM AUGERS	PROJECT NO: 0201-95-12025
WHITEHORSE, YUKON	UTM ZONE: 8 N6738960 E493630	ELEVATION: 670 m

SAMPLE TYPE: GRAB SAMPLE; NO RECOVERY; STANDARD PEN.; 75 mm SPOON; CRREL BARREL; CORE

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(m)
0.0						SAND – trace of silt	670.0
1.0						SILT – trace to some clay, low plastic; fine grained; very stiff; moist; grey	
2.0	☒	1	18			– occasional zones of non-plastic silt – clay content increases with depth – colour becomes a darker grey below 2.5 m	668.0
3.0	☒	2	19			– less sand below 2.5 m	
4.0						SILT AND CLAY – medium plastic; moist to wet; stiff; grey	666.0
5.0	☒	3	10				
6.0	☒	4	9				664.0
7.0							
8.0	☒	5	13			– becomes highly plastic below 8.2 m	662.0
9.0	☒	6	14				
10.0						– becomes blueish grey and firm below 10.0 m	660.0
11.0	☒	7	7				
12.0	☒	8	7				658.0
13.0						END OF BOREHOLE @ 12.5 m – no water table encountered – Borehole is located approximately at Station 11+325 – Elevation is estimated	
14.0							656.0
15.0							



EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: JSB	COMPLETION DEPTH: 12.5 m
	REVIEWED BY: CRH	COMPLETE: 19/10/95
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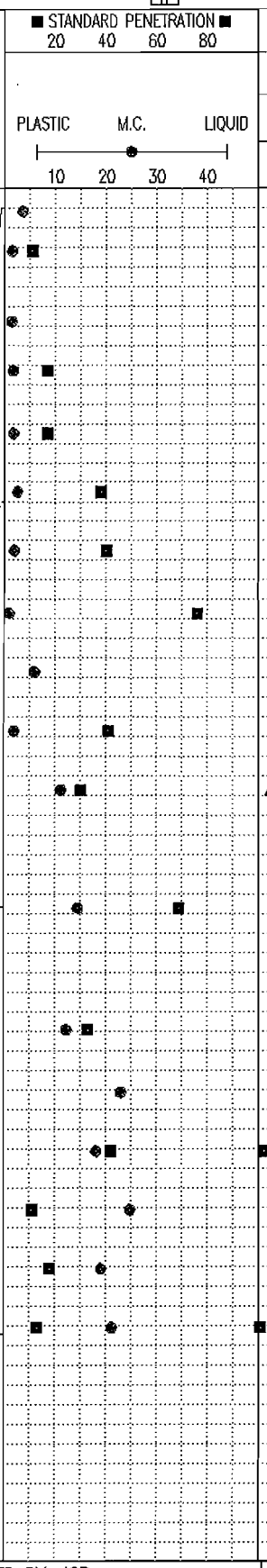
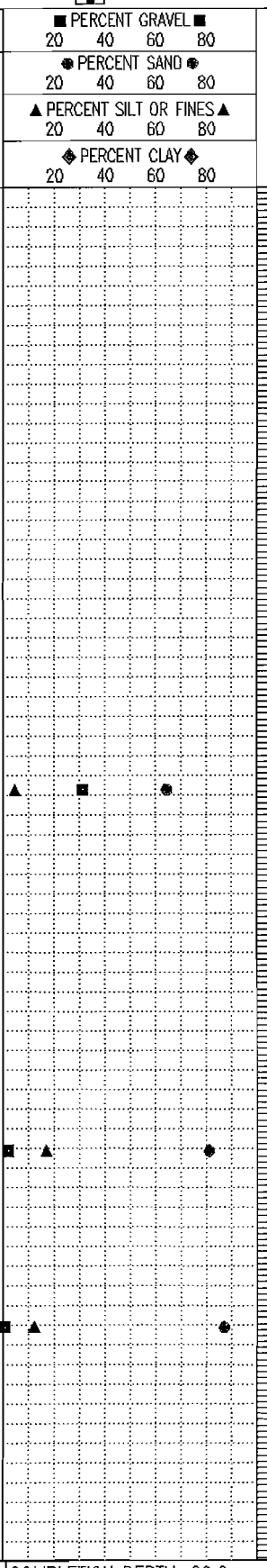
08/07/15 08:38AM (YUKON15)

PORTER CREEK TRANSFER PIPELINE	CLIENT: STANLEY ASSOCIATES ENGINEERING	BOREHOLE NO: 12025-BH05
WHITEHORSE SEWAGE TREATMENT FACILITY	DRILL: CME-75 C/W HOLLOW STEM AUGERS	PROJECT NO: 0201-95-12025
WHITEHORSE, YUKON	UTM ZONE: 8 N6739120 E493660	ELEVATION: 645 m

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY ⊠ STANDARD PEN. ☰ 75 mm SPOON ▯▯ CRREL BARREL ▮ HQ CORE

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0	■	1				SAND – silty; fine grained, uniform sand; soft; dry; yellowish brown
1.0						
2.0	⊠	2	11			SAND – gravelly, trace to some silt; fine to medium sand; fine to medium grained subrounded gravel; loose; dry; medium to dark brown
3.0	■	3				
4.0						– becomes compact below 4.0 m
5.0	⊠	4	17			
6.0	⊠	5	17			
7.0						
8.0	⊠	6	38			– becomes dense below 7.5 m
9.0	⊠	7	40			SAND AND GRAVEL – trace of silt; well graded sand; well graded sub-rounded gravels; dense; dry; light grey
10.0						
11.0	▯▯	8	76			– drilling becomes easier below 8.8 m
12.0		9				– grinding and fairly hard drilling below 12.3 m
13.0						
14.0	▯▯	10	41			– drilling becomes easier below 12.5 m
15.0 ▼	▯▯	11	30			– less gravel, becomes fine to medium grained
16.0						– water table at 15.0 m
17.0						
18.0	▯▯	12	69			SAND – some silt, trace of gravel; medium to coarse grained sand; fine to medium grained sub-rounded gravel; dense; saturated; medium greyish brown
19.0						
20.0	⊠	13				
21.0	⊠	14	33			
22.0						
23.0	⊠	15				
24.0						– little to no gravel below 24.0 m
25.0	⊠	16	42			– becomes siltier below 24.0 m
26.0	⊠	17	11			– sand becomes finer grained below 24.0 m
27.0						
28.0	⊠	18	18			– sand becomed medium to coarse grained below 27.0 m
29.0	⊠	19	13			END OF BOREHOLE @ 29.2 m
30.0						– water table at 15.0 m
31.0						– Borehole located at approximately Station 11+480
32.0						– Elevation is estimated
33.0						
34.0						
35.0						





Depth(ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0, 24.0, 26.0, 28.0, 30.0, 32.0, 34.0, 36.0, 38.0, 40.0, 42.0, 44.0, 46.0, 48.0, 50.0, 52.0, 54.0, 56.0, 58.0, 60.0, 62.0, 64.0, 66.0, 68.0, 70.0, 72.0, 74.0, 76.0, 78.0, 80.0, 82.0, 84.0, 86.0, 88.0, 90.0, 92.0, 94.0, 96.0, 98.0, 100.0, 102.0, 104.0, 106.0, 108.0, 110.0, 112.0, 114.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: JSB	COMPLETION DEPTH: 29.2 m
	REVIEWED BY: CRH	COMPLETE: 19/10/95
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08/07/15 08:38AM (YUKON34)

PORTER CREEK TRANSFER PIPELINE	CLIENT: STANLEY ASSOCIATES ENGINEERING	BOREHOLE NO: 12025-BH06
WHITEHORSE SEWAGE TREATMENT FACILITY	DRILL: CME-75 C/W SOLID SHAFT AUGERS	PROJECT NO: 0201-95-12025
WHITEHORSE, YUKON	UTM ZONE: 8 N6739020 E493600	ELEVATION: 655 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▥ CRREL BARREL

Depth(m)	SAMPLE TYPE	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(m)
0.0					SILT – some sand; fine grained; uniform sand; soft; dry; light yellowish brown	655.0
1.0	■					
2.0					– drilling becomes a little harder below 1.8 m	653.0
					SILT – clayey; low plastic; damp; stiff; grey	
3.0	■				– clay content increases with depth	
4.0						651.0
5.0	■					
6.0						649.0
	■				– drilling becomes easy below 6.5 m	
7.0						
8.0					END OF BOREHOLE @ 7.6 m – no water table encountered – Borehole located at approximately Station 11+400 – Elevation is estimated	647.0
9.0						
10.0						645.0

PLASTIC M.C. LIQUID
10 20 30 40

■ PERCENT GRAVEL ■
20 40 60 80

● PERCENT SAND ●
20 40 60 80

▲ PERCENT SILT OR FINES ▲
20 40 60 80

◆ PERCENT CLAY ◆
20 40 60 80

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Whitehorse, Yukon

LOGGED BY: JSB
REVIEWED BY: CRH

COMPLETION DEPTH: 7.6 m
COMPLETE: 24/10/95

08/07/15 08:38AM (YUKON-9)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-01
GEOTECHNICAL EVALUATION	DRILL: TRUCK MOUNTED CME-75	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6737500 E493700	ELEVATION: 696.6 m

SAMPLE TYPE: GRAB | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL | DISTURBED

Depth(m)	SAMPLE TYPE	RUN NO	SOIL DESCRIPTION	ELEVATION(m)
0.0				696.6
	GRAB	1	(SURFACING GRAVEL) SAND – silty, some gravel, fine grained, seasonally frozen, olive brown	
			GRAVEL – sandy, some silt, gravel up to 40 mm diameter, seasonally frozen, medium brown	
	GRAB	2		
1.0			– sandier, cleaner and easier to drill from 1.2 m to 1.8 m	
	GRAB	3		
2.0			– seasonal frost ends at 2.2 m	694.0
3.0	GRAB	4		
			END OF BOREHOLE @ 3.5 m – drilled at STA 2+990	
4.0				692.0
5.0				

PLASTIC — M.C. — LIQUID
10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80
● PERCENT SAND ● 20 40 60 80
▲ PERCENT SILT OR FINES ▲ 20 40 60 80
◆ PERCENT CLAY ◆ 20 40 60 80

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LOGGED BY: MCP	COMPLETION DEPTH: 3.5 m
REVIEWED BY: MCP	COMPLETE: 95/01/31
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08/07/15 08:28AM (YUKON-5)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-02
GEOTECHNICAL EVALUATION	DRILL: TRUCK MOUNTED CME-75	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6737170 E494115	ELEVATION: 681.5 m

SAMPLE TYPE: GRAB | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL | DISTURBED

Depth(m)	SAMPLE TYPE	RUN NO	SOIL DESCRIPTION	PLASTIC / M.C. / LIQUID	PERCENT GRAVEL / PERCENT SAND / PERCENT SILT OR FINES / PERCENT CLAY	ELEVATION(m)
0.0						
	GRAB	1	(SURFACING GRAVEL) SAND – silty, some gravel, fine grained, seasonally frozen, light brown			
			SAND – some silt, trace of fine gravel, brown			
	GRAB	2	seasonally frozen, medium brown medium grained, damp, loose, medium			681.0
1.0						
			SILT – some clay, seasonally frozen to approximately 2.2 m, moist becoming wet below frost, firm where moist and soft where wet, olive brown			
	GRAB	3				
2.0			– easy drilling			679.0
3.0	GRAB	4				
			END OF BOREHOLE @ 3.5 m – drilled at STA 2+440			
4.0						677.0
5.0						

PLASTIC / M.C. / LIQUID: 10 20 30 40

PERCENT GRAVEL: 20 40 60 80

PERCENT SAND: 20 40 60 80

PERCENT SILT OR FINES: 20 40 60 80

PERCENT CLAY: 20 40 60 80

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Whitehorse, Yukon

LOGGED BY: MCP	COMPLETION DEPTH: 3.5 m
REVIEWED BY: MCP	COMPLETE: 95/01/31
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08/07/15 08:28AM (YUKON-5)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-03
GEOTECHNICAL EVALUATION	DRILL: TRUCK MOUNTED CME-75	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6736770 E494380	ELEVATION: 665 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ☰ 75 mm SPOON ⫼ CRREL BARREL

SOIL DESCRIPTION

■ STANDARD PENETRATION (N) ■ 20 40 60 80

◆ DCPT ◆ 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80

● PERCENT SAND ● 20 40 60 80

▲ PERCENT SILT OR FINES ▲ 20 40 60 80

◆ PERCENT CLAY ◆ 20 40 60 80

Depth(m)	SAMPLE TYPE	SPT(N)	SOIL DESCRIPTION	ELEVATION(m)
0.0	■		(SURFACING GRAVEL) SAND – silty, some gravel, fine grained, seasonally frozen, medium brown	665.0
			SILT – some clay, trace of fine sand, seasonally frozen, olive brown	
1.0				
	■			
2.0			– seasonal frost ends at 2.0m – wet below frost line	663.0
3.0	■			
			– slightly drier from 3.2 m to 3.4 m	
4.0				661.0
			– interbedded wet and very wet silts	
5.0				
			– moist below 5.5 m	
6.0	■			659.0
			END OF BOREHOLE @ 6.2 m – drilled at STA 1+490	
7.0				
8.0				657.0
9.0				

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LOGGED BY: MCP
REVIEWED BY: MCP

COMPLETION DEPTH: 6.2 m
COMPLETE: 95/01/31

08/07/15 08:29AM (YUKON-8)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-07
GEOTECHNICAL EVALUATION	DRILL: SHOP BUILT AUGER RIG	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6736980 E494310	ELEVATION: 681.5 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▥ CRREL BARREL

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	■ STANDARD PENETRATION ■ 10 20 30 40 / ◆ DCPT ◆ 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	■ PERCENT GRAVEL ■ 20 40 60 80 / ● PERCENT SAND ● 20 40 60 80 / ▲ PERCENT SILT OR FINES ▲ 20 40 60 80 / ◆ PERCENT CLAY ◆ 20 40 60 80	ELEVATION(ft)
0.0						ORGANIC ROOT MAT OVER SILT – moist, black			2236.0
						SAND – trace of silt, medium grained, seasonally frozen, damp when thawed, medium brown			
1.0		1							2234.0
									2232.0
						SILT – trace of fine sand, trace of clay, damp, firm (est.), medium brown			2230.0
2.0		2							2228.0
						END OF BOREHOLE @ 2.5 m – drilled at STA 0+050 along Golf Course Access Road			
3.0									2226.0
									2224.0
4.0									2222.0

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LOGGED BY: MCP	COMPLETION DEPTH: 2.5 m
REVIEWED BY: MCP	COMPLETE: 95/04/20
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08/07/15 08:29AM (YUKON-4)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-08
GEOTECHNICAL EVALUATION	DRILL: SHOP BUILT AUGER RIG	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6737190 E494620	ELEVATION: 681 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▥ CRREL BARREL

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(m)
0.0						ORGANIC ROOT MAT OVER SILT – seasonally frozen, black over dark brown	681.0
	■	1				SAND – trace of silt, medium grained, seasonally frozen, damp when thawed, medium brown	
1.0						– trace of fine gravel at interface with silt	
						SILT – trace of fine sand, trace of clay, damp to moist with depth, olive brown	
2.0	■	2					679.0
3.0						– wet below 3.0 m	
	■	3					
4.0						END OF BOREHOLE @ 3.8 m – drilled at STA 0+450 along Golf Course Access Road	677.0
5.0							
6.0							675.0
7.0							

■ STANDARD PENETRATION ■ 10 20 30 40

PLASTIC M.C. LIQUID 10 20 30 40

◆ PERCENT GRAVEL ◆ 20 40 60 80

▲ PERCENT SAND ▲ 20 40 60 80

■ PERCENT SILT OR FINES ■ 20 40 60 80

● PERCENT CLAY ● 20 40 60 80

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP	COMPLETION DEPTH: 3.8 m
	REVIEWED BY: MCP	COMPLETE: 95/04/20
		Page 1 of 1

08/07/15 08:29AM (YUKON-6)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-09
GEOTECHNICAL EVALUATION	DRILL: SHOP BUILT AUGER RIG	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6737330 E494760	ELEVATION: 673.1 m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	STANDARD PENETRATION 10 20 30 40 / DCPT 10 20 30 40 / PLASTIC M.C. LIQUID 10 20 30 40	PERCENT GRAVEL 20 40 60 80 / PERCENT SAND 20 40 60 80 / PERCENT SILT OR FINES 20 40 60 80 / PERCENT CLAY 20 40 60 80	ELEVATION(ft)
0.0						ORGANIC ROOT MAT OVER SILT – moist, black and brown			2208.0
						SAND – trace of silt, medium grained, seasonally frozen, moist to wet when thawed, medium brown becoming grey below 1.0 m			
		1							2206.0
1.0						– easy to drill			
									2204.0
2.0						SILT – some clay, trace of fine sand, wet, soft, olive grey			2202.0
		2							
						END OF BOREHOLE @ 2.5 m – drilled at STA 0+650 along Golf Course Access Road			2200.0
3.0									2198.0
									2196.0
4.0									2194.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP	COMPLETION DEPTH: 2.5 m
	REVIEWED BY: MCP	COMPLETE: 95/04/20
		Page 1 of 1

08/07/15 08:29AM (YUKON-4)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-10
GEOTECHNICAL EVALUATION	DRILL: SHOP BUILT AUGER RIG	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6737330 E494760	ELEVATION: 673.1 m

SAMPLE TYPE ■ GRAB SAMPLE ⊘ NO RECOVERY ⊠ STANDARD PEN. ▤ 75 mm SPOON ▥ CRREL BARREL

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(ft)
0.0						ORGANIC ROOT MAT OVER SILT – moist, black and brown	2208.0
	■	1				SAND – trace of silt, medium to fine grained, dry to damp, medium to light brown	2206.0
1.0							2204.0
2.0							2202.0
	■	2					2200.0
						END OF BOREHOLE @ 2.5 m – drilled at STA 0+920 along Golf Access Road	
3.0							2198.0
							2196.0
4.0							2194.0

■ STANDARD PENETRATION ■ 10 20 30 40
◆ DCPT ◆ 10 20 30 40
PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80
● PERCENT SAND ● 20 40 60 80
▲ PERCENT SILT OR FINES ▲ 20 40 60 80
◆ PERCENT CLAY ◆ 20 40 60 80

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP	COMPLETION DEPTH: 2.5 m
	REVIEWED BY: MCP	COMPLETE: 95/04/20
		Page 1 of 1

08/07/15 08:29AM (YUKON-4)

RANGEWAY ROAD CONSTRUCTION	CLIENT: DAVID NAIRNE & ASSOCIATES	BOREHOLE NO: 11731-11
GEOTECHNICAL EVALUATION	DRILL: SHOP BUILT AUGER RIG	PROJECT NO: 0201-11731
WHITEHORSE, YUKON	UTM ZONE: 8 N6737640 E495130	ELEVATION: 682 m

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | STANDARD PEN. | 75 mm SPOON | CRREL BARREL

Depth(m)	SAMPLE TYPE	RUN NO	SPT(N)	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0						ORGANIC ROOT MAT OVER SILT – moist, black over brown
		1				SAND – trace to some silt, fine grained, occasional fragments of coarse grained sand throughout, damp, very loose, light brown
1.0						
2.0		2				
						END OF BOREHOLE @ 2.5 m – drilled at STA 1+120 along Golf Course Access Road
3.0						
4.0						

■ STANDARD PENETRATION ■ 10 20 30 40
◆ DCPT ◆ 10 20 30 40
PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80
● PERCENT SAND ● 20 40 60 80
▲ PERCENT SILT OR FINES ▲ 20 40 60 80
◆ PERCENT CLAY ◆ 20 40 60 80

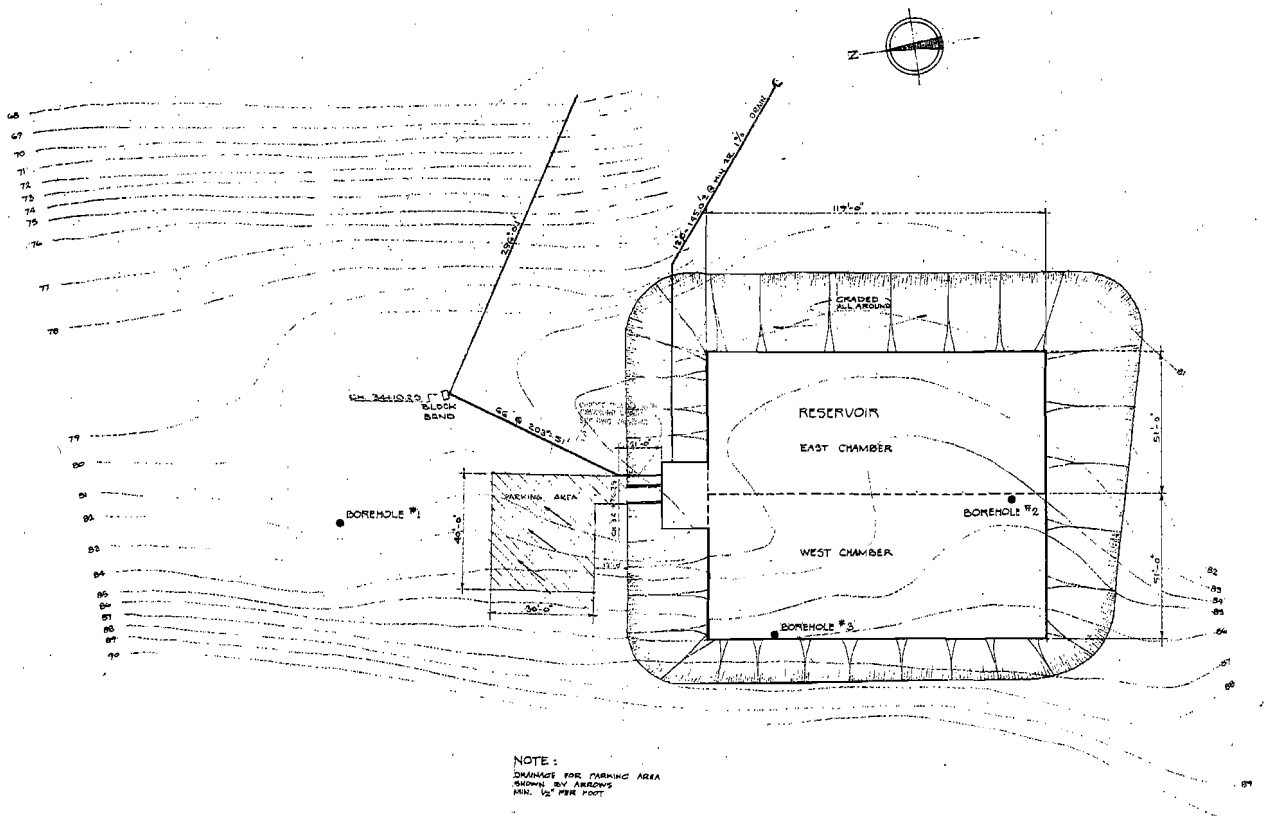
ELEVATION(ft): 2237.0, 2235.0, 2233.0, 2231.0, 2229.0, 2227.0, 2225.0, 2223.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP	COMPLETION DEPTH: 2.5 m
	REVIEWED BY: MCP	COMPLETE: 95/04/20
		Page 1 of 1

08/07/15 08:29AM (YUKON-4)

APPENDIX C

APPENDIX C TESTHOLE LOGS AND LABORATORY DATA – WHISTLE BEND



NOTE :
DRAINAGE FOR PARKING AREA SHOWN BY ARROWS MIN. ½" PER FOOT

BOREHOLE LOG

DEPTH IN FEET	SAMPLES NO	SAMPLES TYPE	BOREHOLE #1
0			
5	1	SS	SILTY, SANDY GRAVEL - NON PLASTIC MAXIMUM SIZE 8" 36% PASS NO 200 SIEVE
10	2	SS	
15	3	SS	BEDROCK - GEOLOGICAL DISCRIPTION: HORNBLENDE - BIOTITE GRANODIORITE
18			BOTTOM OF HOLE
20			

DEPTH IN FEET	SAMPLES NO	SAMPLES TYPE	BOREHOLE #2
0			
5	1	SS	SILTY, SANDY GRAVEL - NON PLASTIC MAXIMUM SIZE 12" 35% PASS NO 200 SIEVE
10	2	SS	
15	3	SS	
20	4	SS	
22			
25	5	SS	BEDROCK - SHEARED & ALTERED GRANODIORITE
28			
30	6	SS	BEDROCK - HORNBLENDE BIOTITE GRANODIORITE
35			BOTTOM OF HOLE
40			

DEPTH IN FEET	SAMPLES NO	SAMPLES TYPE	BOREHOLE #3
0			
5	1	SS	SILTY, SANDY GRAVEL - NON PLASTIC MAXIMUM SIZE 12" 35% PASS NO 200 SIEVE
10	2	SS	
15	3	SS	
20	4	SS	
25	5	SS	BEDROCK - SHEARED & ALTERED GRANODIORITE
30	6	SS	
35	7	SS	BEDROCK - HORNBLENDE BIOTITE - GRANODIORITE
40			

VALLEYVIEW PUMPHOUSE

REV No	DESCRIPTION	DATE	BY
1	GENERAL REVISION	8/JULY/65	B.S.

Consulting Engineers
T.N. HENTON ENGINEERING LTD
8712 - 150 th St
Edmonton Alta

DEPARTMENT OF PUBLIC WORKS
CANADA

DWG. No. W 65-2-11

WHITE HORSE WATER SYSTEM 1965

DATE SEP. 15 1965

RESERVOIR LOCATION PLAN

REV 1

SCALE: 1" = 20'-0"

C 11-2

0401-2

KULAN RESERVOIR SITE

SILTY TILL WITH ROCKS & PEBBLES THROUGHOUT

SILTY TILL WITH LARGE AMOUNTS of SILT.

ROCK

LAYER of FRACTURED ROCK OR TILL. N COUNT @ 10 - 18

ROCK

HOLE STOPPED AT 18 SUSPECT BEDROCK.

BOREHOLE # 1

SILTY GRAVEL OR TILL.

ROCK

SILTY GRAVEL OR TILL

CLAY & SILTY GRAVEL

SILT & SAND WITH GRAVEL. N COUNT

SAND & GRAVEL

SILTY SAND & GRAVEL.

SILTY GRAVEL

N COUNT @ 20 - 79

GREY SILT & GRAVEL WITH CLAY

ROCK.

HOLE STOPPED @ 34 SUSPECT

BOREHOLE # 2

Geotech.Eval-Porter Creek Watermain Phll	CLIENT: City of Whitehorse	TEST PIT NO: 1200125-TP01
Kulan Subdivision	EXCAVATOR: Komatsu PC 150LC	PROJECT NO: 1200125
Whitehorse, YT	UTM ZONE: 8 N6736914 E490922	ELEVATION: 769.4 m

SAMPLE TYPE ■ GRAB ▨ NO RECOVERY ▥ SHELBY TUBE

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					SAND AND SILT (TILL) – some gravel, cobbles and boulders throughout, moist, compact (est.), olive brown
1.0					
2.0					
3.0					– moisture content increasing below 3.0 m
4.0					
5.0 ▼					– water seeping into testpit at approximately 5.0 m
6.0					– possibly bedrock at 5.8 m END OF TESTPIT 5.8 m

PLASTIC M.C. LIQUID
10 20 30 40

■ PERCENT GRAVEL ■
20 40 60 80

● PERCENT SAND ●
20 40 60 80

▲ PERCENT SILT OR FINES ▲
20 40 60 80

◆ PERCENT CLAY ◆
20 40 60 80

ELEVATION(m)
769.0
767.0
765.0
763.0

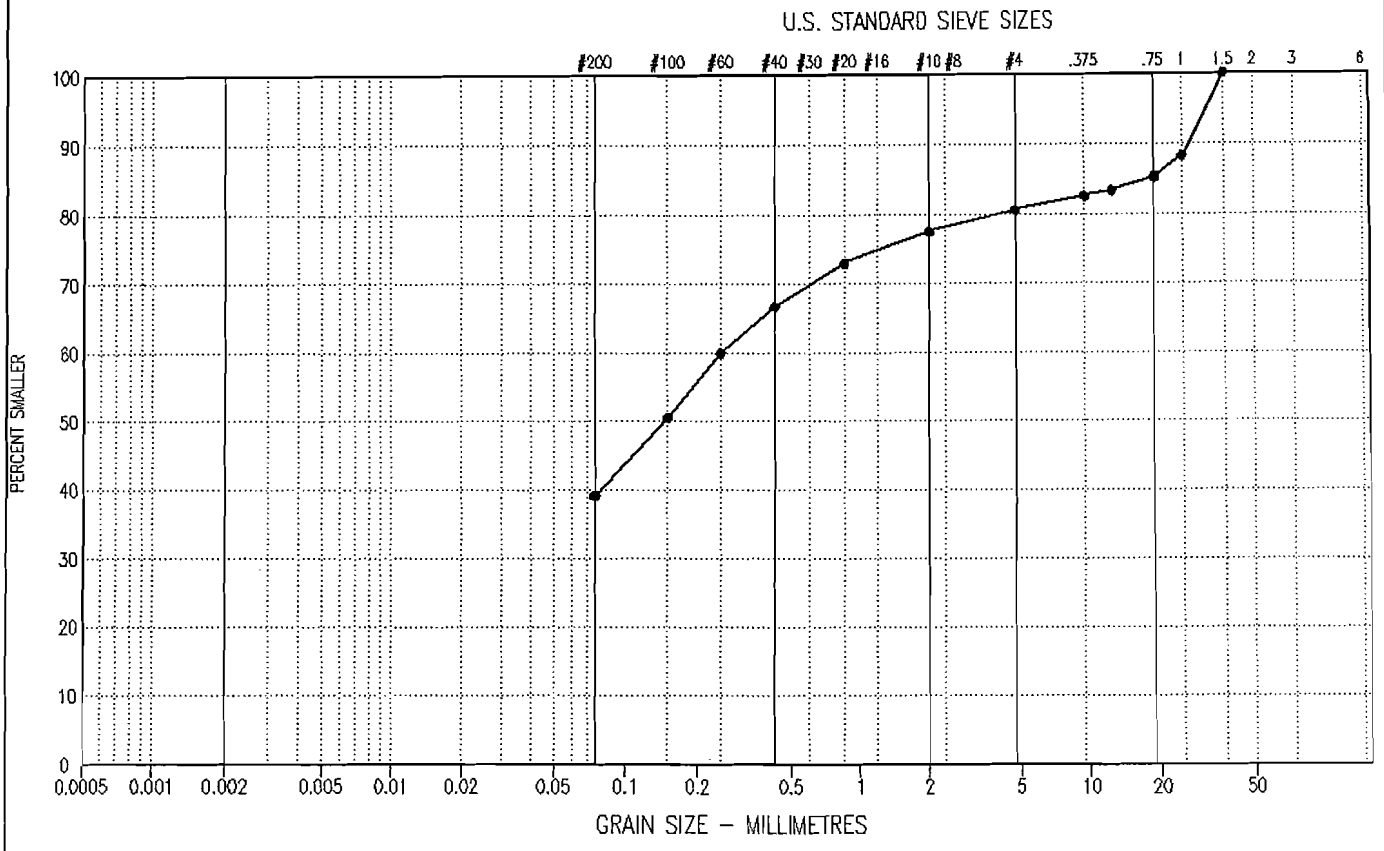
EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: MCP
	REVIEWED BY: JRT
	COMPLETION DEPTH: 5.8 m
	COMPLETE: 04/10/28
	Page 1 of 1

04/11/09 01:32PM (YUKON-TB)

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

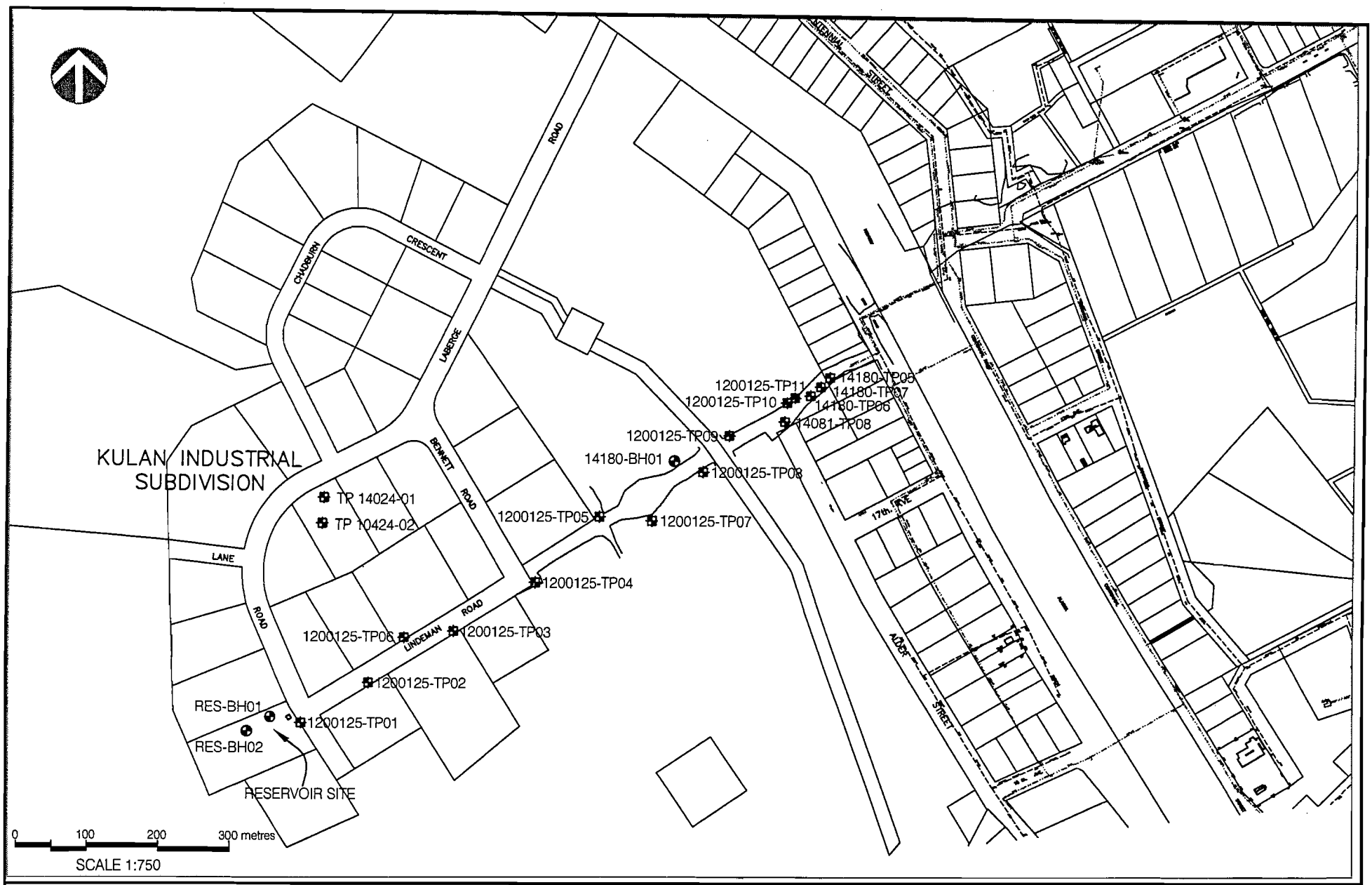
CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	1200125–TP01	2.00	39	42	20	–	–	

Project: 0201–1200125 Date Tested: 04/11/04 BY: PO

Tested in accordance with ASTM D422 unless otherwise noted.



EBA Engineering Consultants Ltd.		PROJECT	GEOTECHNICAL EVALUATION PORTER CREEK WATERMAIN PH III - WHITEHORSE, YUKON
CLIENT	ENGINEERING DEPARTMENT Quest Engineering Group	TITLE	SITE PLAN SHOWING TESTHOLE LOCATIONS
DATE NOV. 2004	DWN. JSB	CHKD. MCP	FILE NO. 1200125 DRWG. FIGURE 1

WHISTLE BEND SUBDIVISION

Current Borehole Logs and Associated Laboratory Test Result Reports Forms

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH01
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6736721N; 493953E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m^3) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	◆ CLAY (%) ◆ 20 40 60 80; ● SILT (%) ● 20 40 60 80; ▲ SAND (%) ▲ 20 40 60 80; ■ GRAVEL (%) ■ 20 40 60 80	Depth (ft)
0	Grass and Labrador Tea ground cover over organic root material						0
	SAND - silty, trace organics, seasonally frozen, damp below frost, medium brown		1		●		
1	- sand becomes some silt, fine grained, uniform, damp, greyish brown below 0.5 m						
			2		●		5
2	- some gravel below 2.0 m						
			3		●		
3							10
4	- very easy drilling to 4.0 m						
	GRAVEL AND SAND - trace silt, likely cobbles, very compact, dark brown		4		●		
5							15
			5		●		
6							20
7			6		●	● ▲ ■	
							25
8							
			7		●		
9	END OF BOREHOLE @ 9.0 m						30
10							33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 9m
REVIEWED BY:	COMPLETE: 12/8/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: September 17, 2008

Tespit Number: BH01-6

Depth: 7.5 m

Soil Description: GRAVEL AND SAND - trace silt

Cu: 40.1

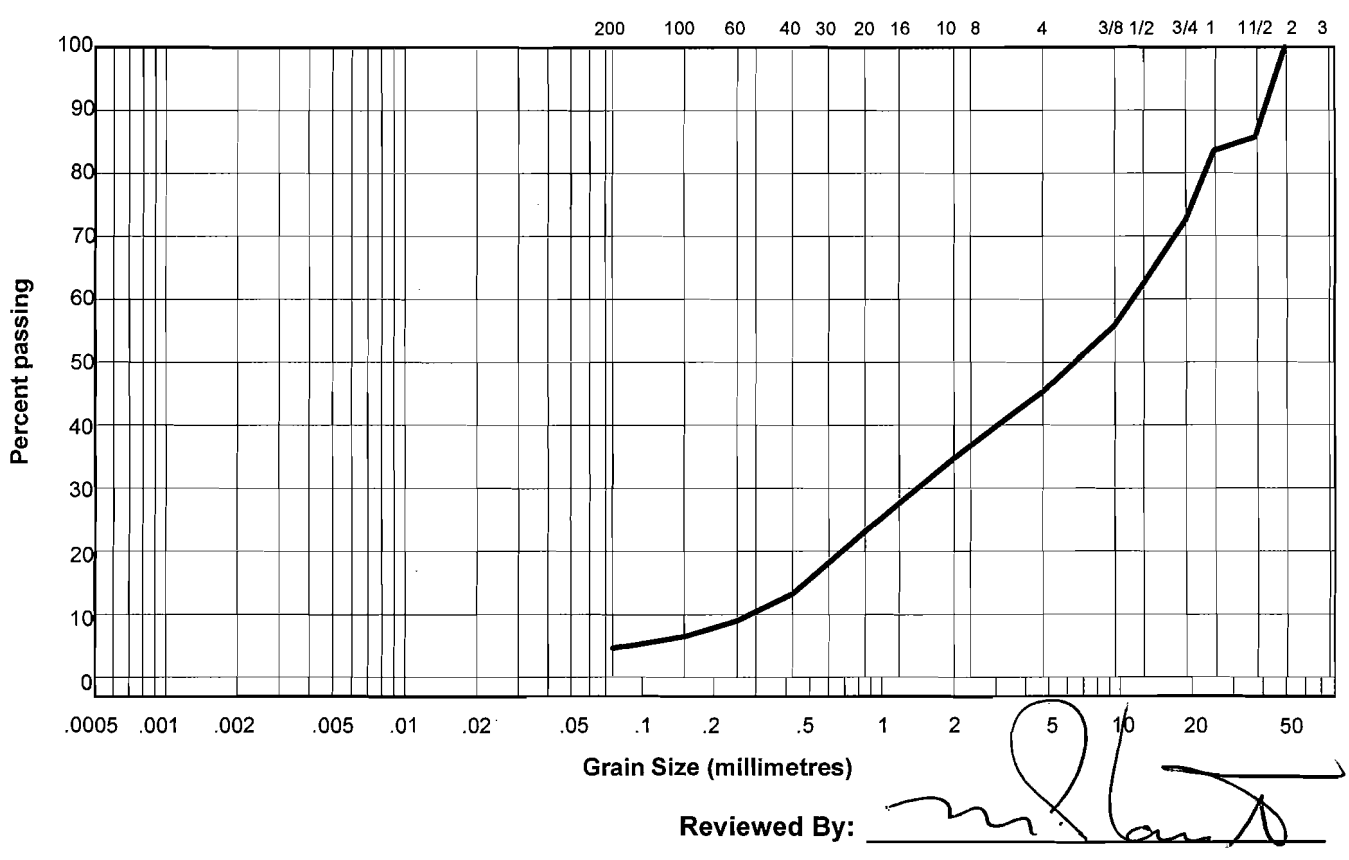
Cc: 0.6

Natural Moisture Content: 1.2%

Remarks:

Sieve Size	Percent Passing
50.000	100
37.500	86
25.000	84
19.000	73
12.500	62
9.500	56
4.750	45
2.000	35
0.850	23
0.425	13
0.250	9
0.150	7
0.075	4.6

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH02
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6736796N; 494022E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SAND - silty, trace organics, fine grained, uniform, damp to dry below seasonal frost, dark brown		1	
1				
2	- cleaner and coarser below 2.0 m, gravel fragments below 2.8 m		2	
3	SAND AND GRAVEL - trace silt, occassional cobble below 3.5 m, damp, very compact, hard drilling, dark brown		3	
4			4	
5	- refusal at 5.0 m on first attempt, backed up 1.0 m, refusal on second attempt END OF BOREHOLE @ 5.0 m			
6				
7				
8				
9				
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

◆ CLAY (%) ◆ 20 40 60 80

● SILT (%) ● 20 40 60 80

▲ SAND (%) ▲ 20 40 60 80

■ GRAVEL (%) ■ 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 5m
REVIEWED BY:	COMPLETE: 12/8/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 9, 2008

Tespit Number: BH02-4

Depth: 4.5 m

Soil Description: SAND AND GRAVEL - trace silt

Cu: 9.2

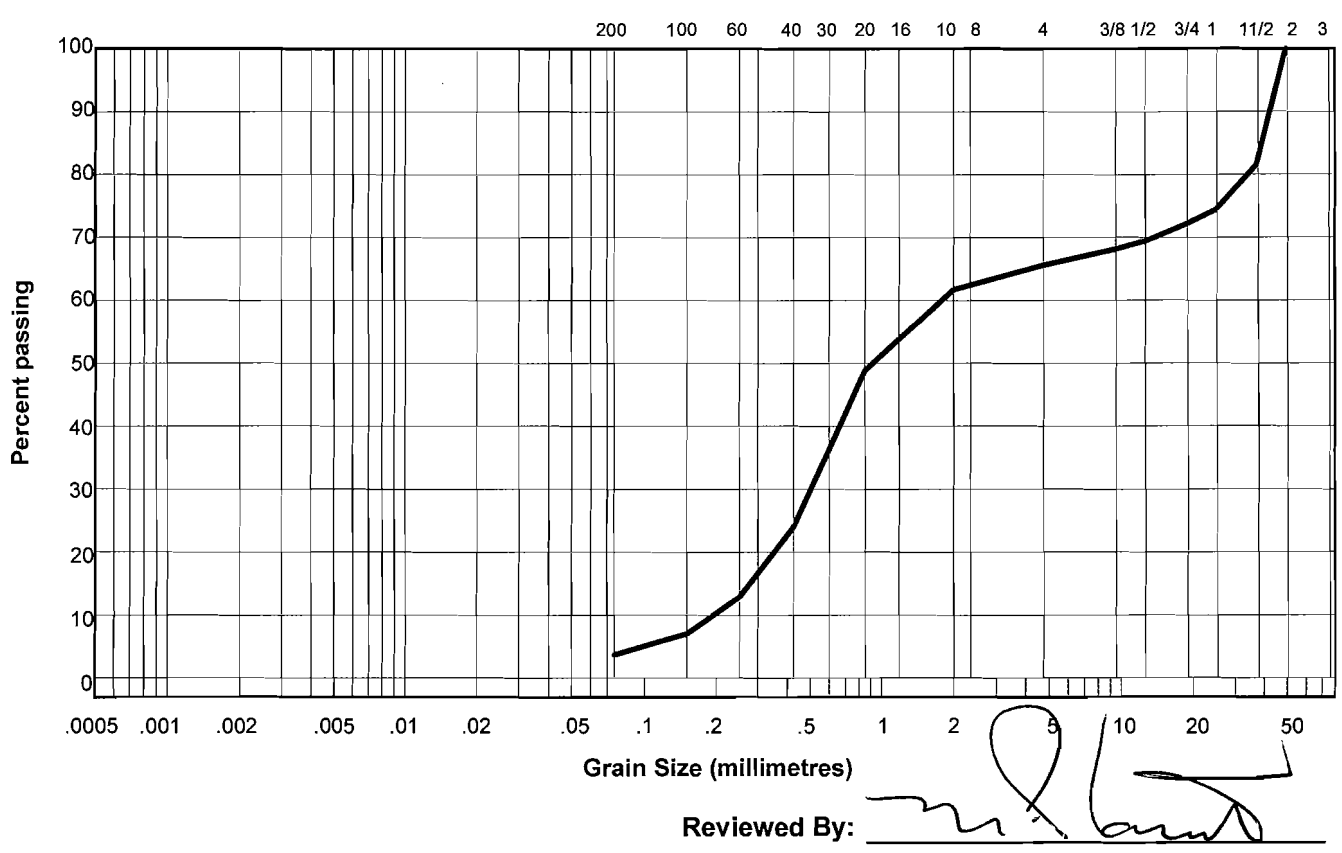
Cc: 0.7

Natural Moisture Content: 2.6%

Remarks:

Sieve Size	Percent Passing
50.000	100
37.500	82
25.000	74
19.000	72
12.500	69
9.500	68
4.750	66
2.000	62
0.850	49
0.425	24
0.250	13
0.150	7
0.075	3.6

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH03
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6736852N; 494158E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Depth (ft)
0	SAND AND SILT (FILL) - trace gravel (along ditch)		1				0
	ORGANIC FILL LINE						
1	SAND - some silt becoming trace silt by 1.0 m, trace gravel, medium to fine grained, damp, dark brown						
			2				5
2	SILT - some clay, trace of fine grained sand, wet, soft, olive brown - very easy to drill						
			3				10
3							
4			4				15
	END OF BOREHOLE @ 4.5 m						
5							
6							20
7							
8							25
9							
							30
10							33

EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 4.5m
	REVIEWED BY:	COMPLETE: 12/8/2008
	DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 9, 2008

Tespit Number: BH03-2

Depth: 1.5 m

Soil Description: SAND - trace gravel, trace silt

Cu: 1.8

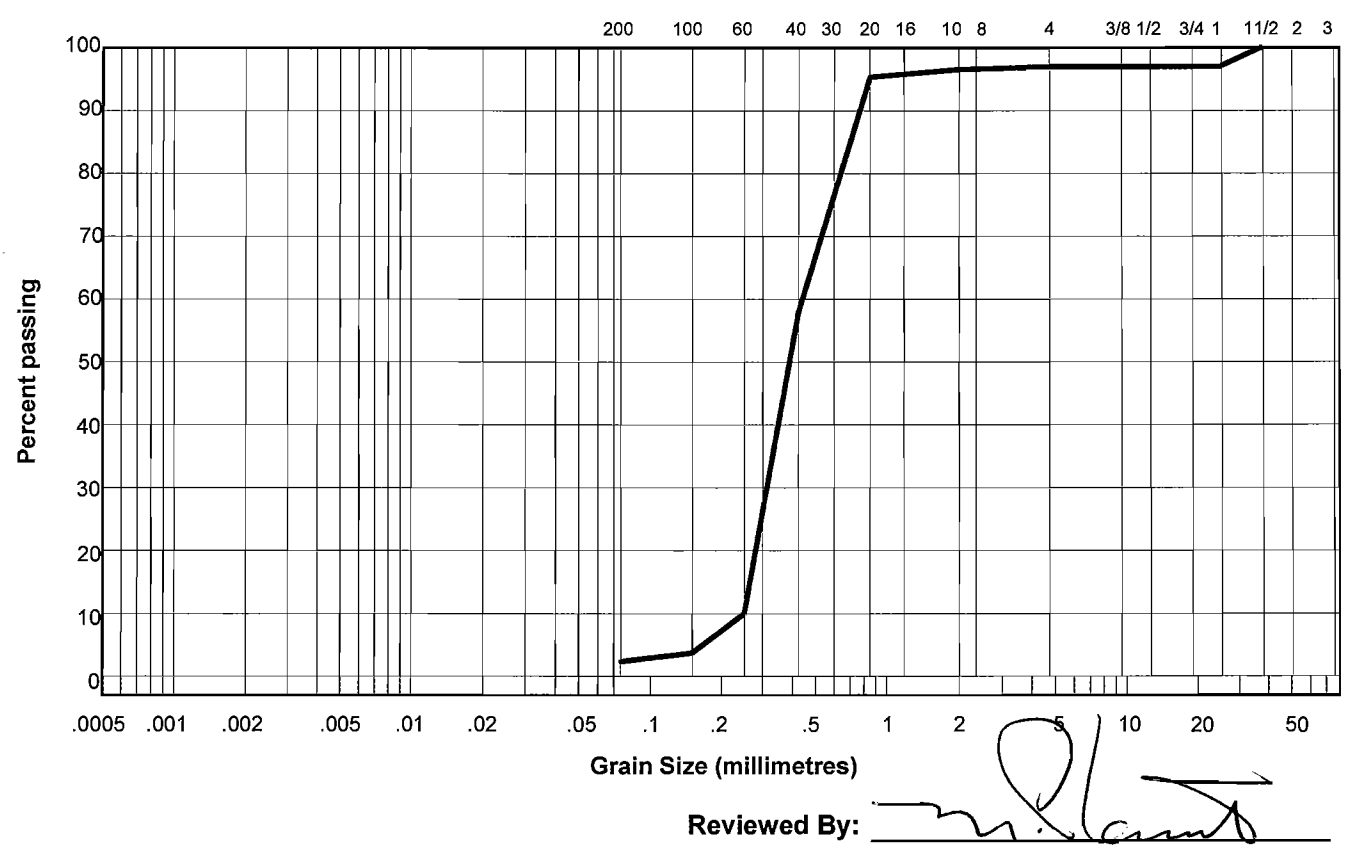
Cc: 0.9

Natural Moisture Content: 2.9%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	100
25.000	97
19.000	97
12.500	97
9.500	97
4.750	97
2.000	97
0.850	95
0.425	58
0.250	10
0.150	4
0.075	2.4

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH04
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6736277N; 494550E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SILT WITH SAND AND ORGANICS (FILL) - seasonally frozen, moist below seasonal frost, brown with organic black		1	
1			2	
2	- sandy from 1.5 m to 2.5 m			
	Fill line at 2.5 m. organics, moist, black		3	
3	SILT - some clay, some fine sand, wet to saturated by 4.5 m, very soft, dark grey			
4			4	
5	- not as saturated and firmer between 4.5 and 5.5 m			
6			5	
7			6	
	END OF BOREHOLE @ 7.5 m			
8				
9				
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

◆ CLAY (%) ◆ 20 40 60 80

● SILT (%) ● 20 40 60 80

▲ SAND (%) ▲ 20 40 60 80

■ GRAVEL (%) ■ 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 7.5m
REVIEWED BY:	COMPLETE: 12/9/2008
DRAWING NO:	Page 1 of 1

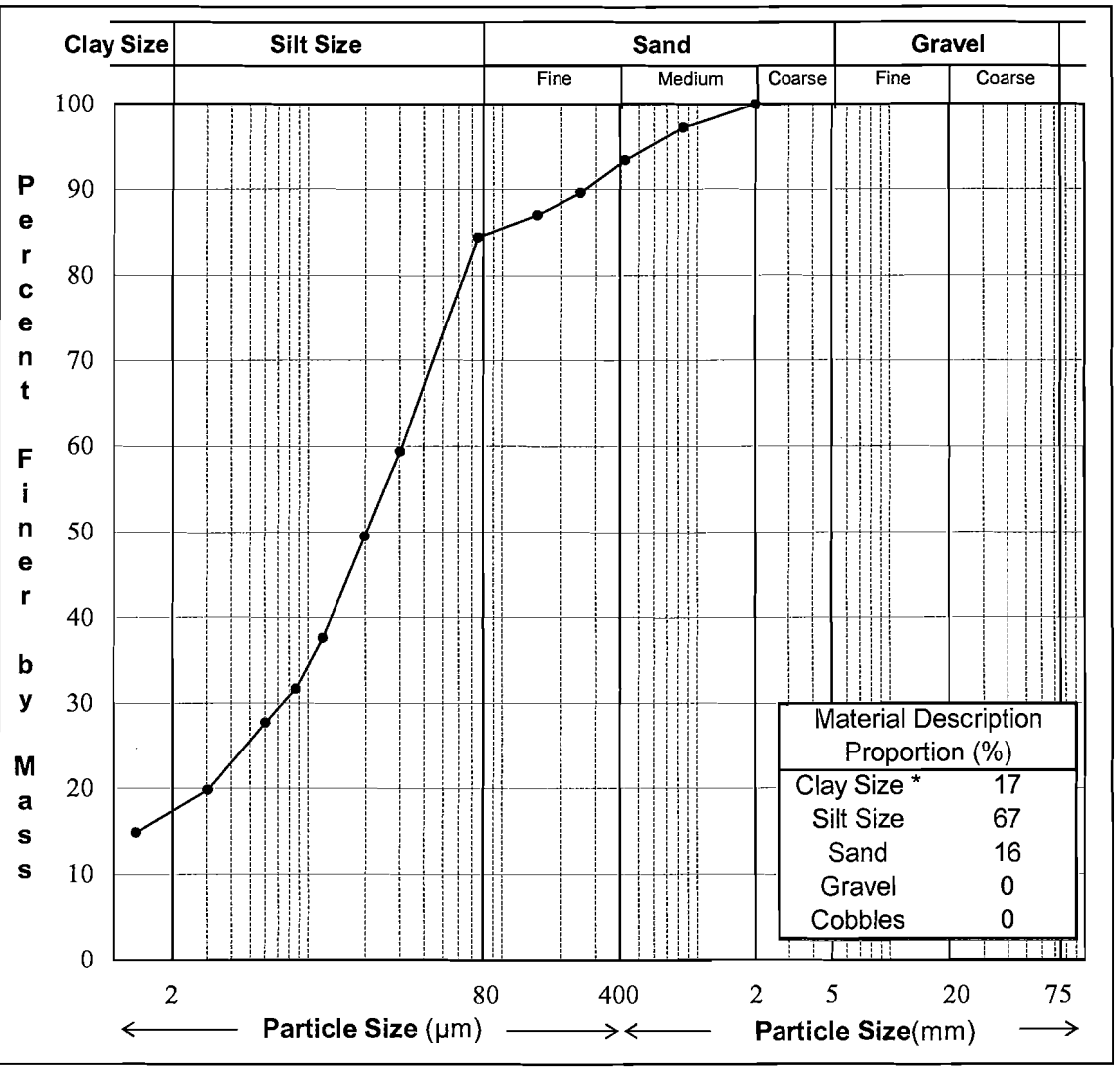
MGP W14101171.GPJ EBA.GDT 09/01/30

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/09
Client: AECOM
Project No.: W14101171
Location:
Sample No.: BH04-4
Depth: 5.4 m
Description**: SILT - some clay, some sand

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 µm	97
425 µm	93
250 µm	90
150 µm	87
75 µm	84
30 µm	59
20 µm	50
12 µm	38
9 µm	32
6 µm	28
3 µm	20
1 µm	15



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By: _____

EBA Engineering Consultants Ltd. eba

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH05
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6736224N; 494478E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	ORGANICS AND WOOD FRAGMENTS		1	
	SILT - some fine sand, some clay, trace organics, saturated, very soft, dark grey			
1			2	
	- groundwater at 1.5 m - same elevation as McIntyre Creek			
2				
3	- less sand and slightly lower moisture content by 3.0 m		3	
4	- trace to some sand and well rounded up to 2.5 mm diameter from 4.0 m to 5.0 m (lens), brownish, cast to silt matrix		4	
5				
	- silt is slightly drier and firmer from 5.5 to 6.0 m, dark grey		5	
6				
7			6	
8				
9			7	
	SAND - some gravel, trace silt, trace clay, saturated, brown			
10				

Bulk Density(kg/m^3) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80

CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 10.5m
	REVIEWED BY:	COMPLETE: 12/9/2008
	DRAWING NO:	Page 1 of 2

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH05
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6736224N; 494478E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

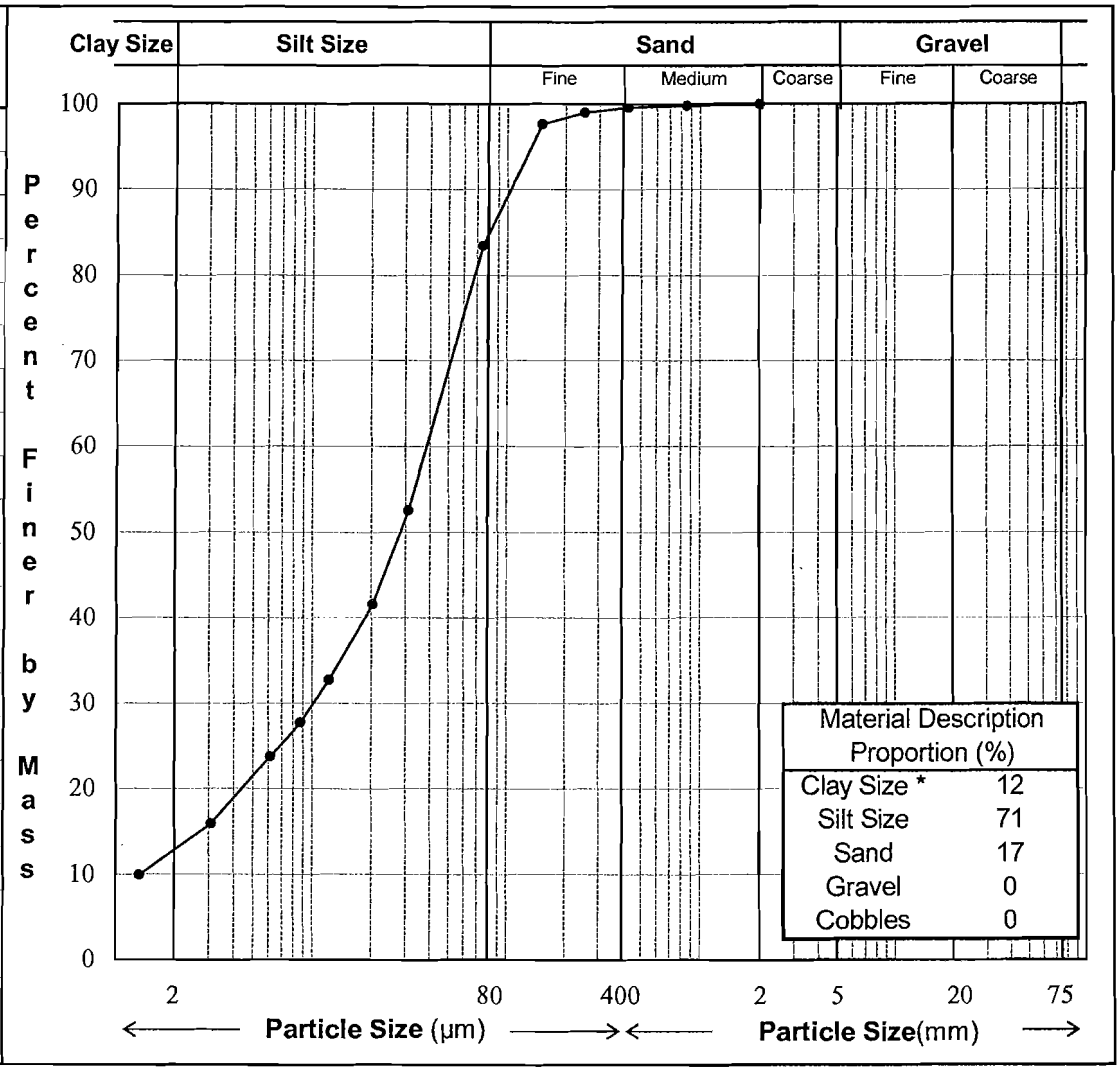
Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Depth (ft)
10	- poor sample recovery at 10 m		8				35
	END OF BOREHOLE @ 10.5 m						
11							
12							40
13							
14							45
15							
16							50
17							
18							55
19							
20							60
							65
							66

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/09
Client: EACOM
Project No.: W14101171
Location:
Sample No.: BH05-5
Depth: 6.0 m
Description**: SILT - some sand, some clay

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 µm	100
425 µm	100
250 µm	99
150 µm	98
75 µm	83
31 µm	52
20 µm	42
12 µm	33
9 µm	28
6 µm	24
3 µm	16
1 µm	10



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By: _____

EBA Engineering Consultants Ltd.

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 9, 2008

Tespit Number: BH05-8

Depth: 10.5 m

Soil Description: SAND - some gravel, trace silt

Cu: 5.7

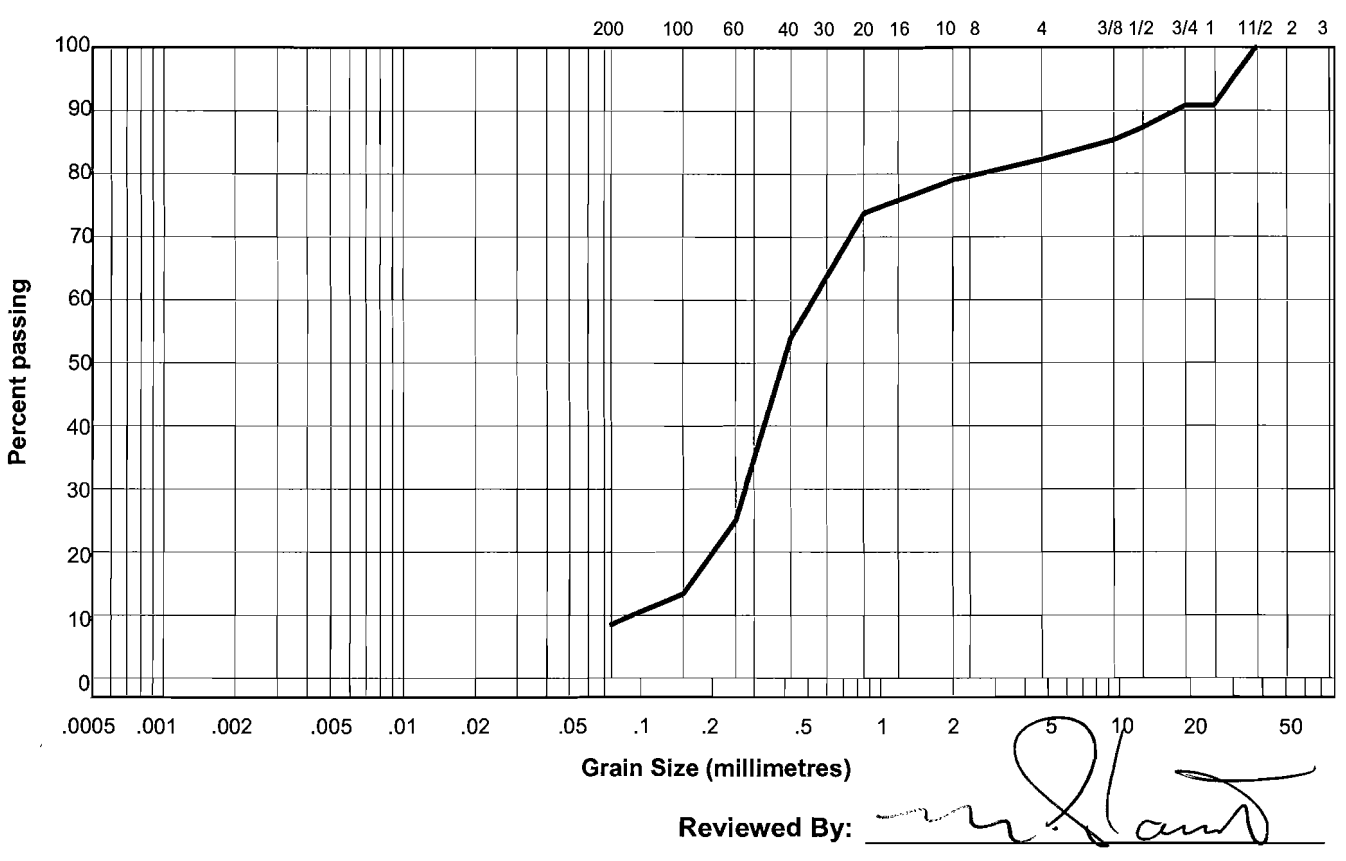
Cc: 1.6

Natural Moisture Content: 17.7%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	100
25.000	91
19.000	91
12.500	87
9.500	85
4.750	82
2.000	79
0.850	74
0.425	54
0.250	25
0.150	13
0.075	8.6

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH06
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6736288N; 494380E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SILT AND ORGANICS (FILL) - some gravel, some to trace sand, moist, brown/black		1	
1				
2	SILT - some sand, trace clay, wet, soft, grey		2	
3	SAND AND SILT - some gravel, saturated, loose, dark brown		3	
	- groundwater at 3.0 m, sample recovery below 3.0 m is poor due to groundwater			
4	GRAVEL AND SAND - trace to some silt, saturated, loose, dark brown		4	
5				
6			5	
7			6	
8	END OF BOREHOLE @ 7.5 m			
9				
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

CLAY (%) 20 40 60 80

SILT (%) 20 40 60 80

SAND (%) 20 40 60 80

GRAVEL (%) 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 7.5m
REVIEWED BY:	COMPLETE: 12/9/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 10, 2008

Tespit Number: BH06-3

Depth: 3.0 m

Soil Description: SAND AND SILT - some gravel

Cu:

Cc:

Natural Moisture Content: 18.3%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	100
19.000	92
12.500	88
9.500	85
4.750	82
2.000	79
0.850	76
0.425	69
0.250	53
0.150	38
0.075	25.4

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse

Reviewed By:

EBA Engineering Consultants Ltd.

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 10, 2008

Tespit Number: BH06-5

Depth: 6.0 m

Soil Description: GRAVEL AND SAND - trace silt

Cu: 130.5

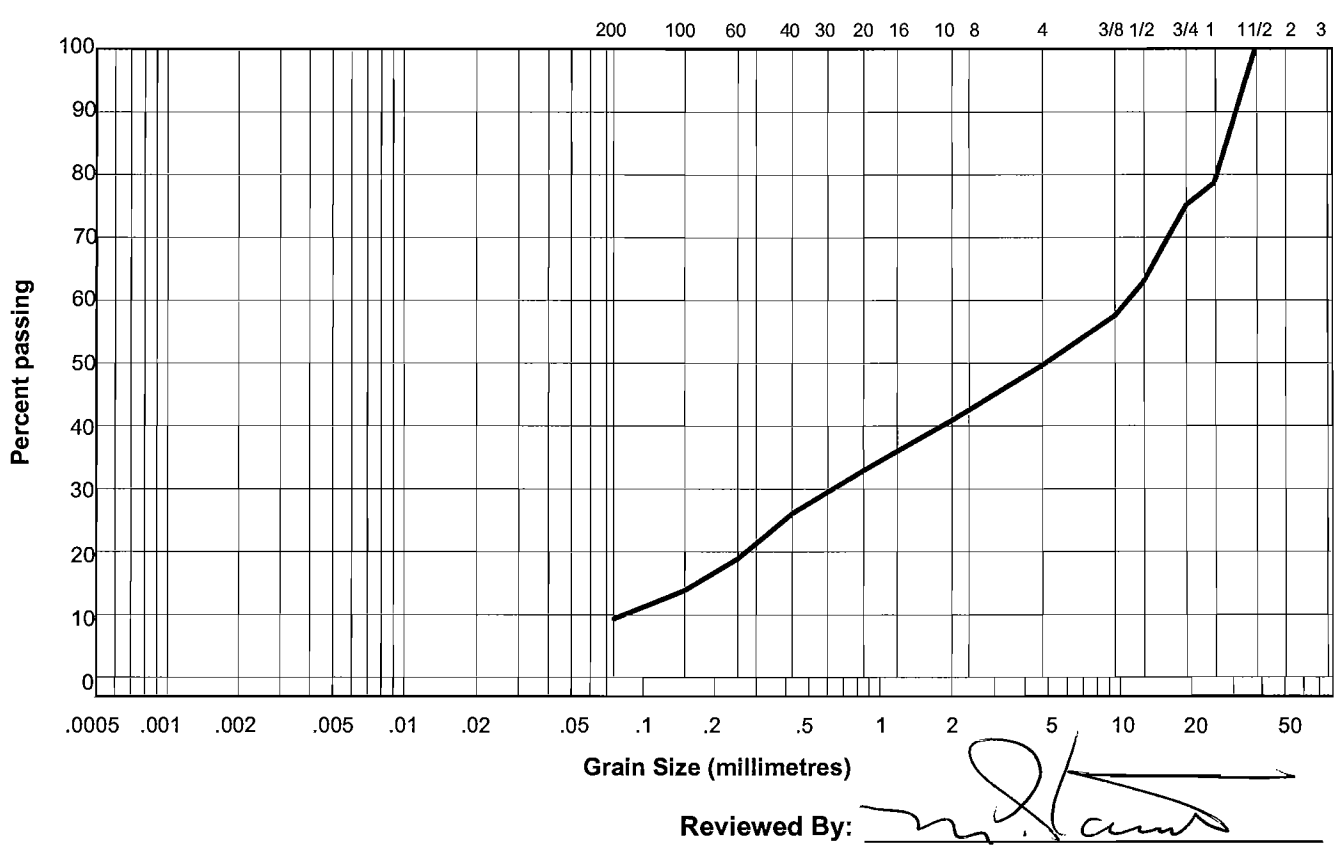
Cc: 0.4

Natural Moisture Content: 12.7%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	100
25.000	79
19.000	75
12.500	63
9.500	58
4.750	50
2.000	41
0.850	33
0.425	26
0.250	19
0.150	14
0.075	9.4

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH07
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6737137N; 494178E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SILT - some sand, some gravel, damp below seasonal frost, firm, olive brown			
1			1	
2				
3	SILT - some clay, moist to wet, soft, olive brown		2	
4	- plasticity increased by 4.0 m		3	
5	- trace of sand (thin lenses), medium from 4.8 to 6.0 m			
6			4	
	END OF BOREHOLE @ 6.0 m			
7				
8				
9				
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

◆ CLAY (%) ◆ 20 40 60 80

● SILT (%) ● 20 40 60 80

▲ SAND (%) ▲ 20 40 60 80

■ GRAVEL (%) ■ 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

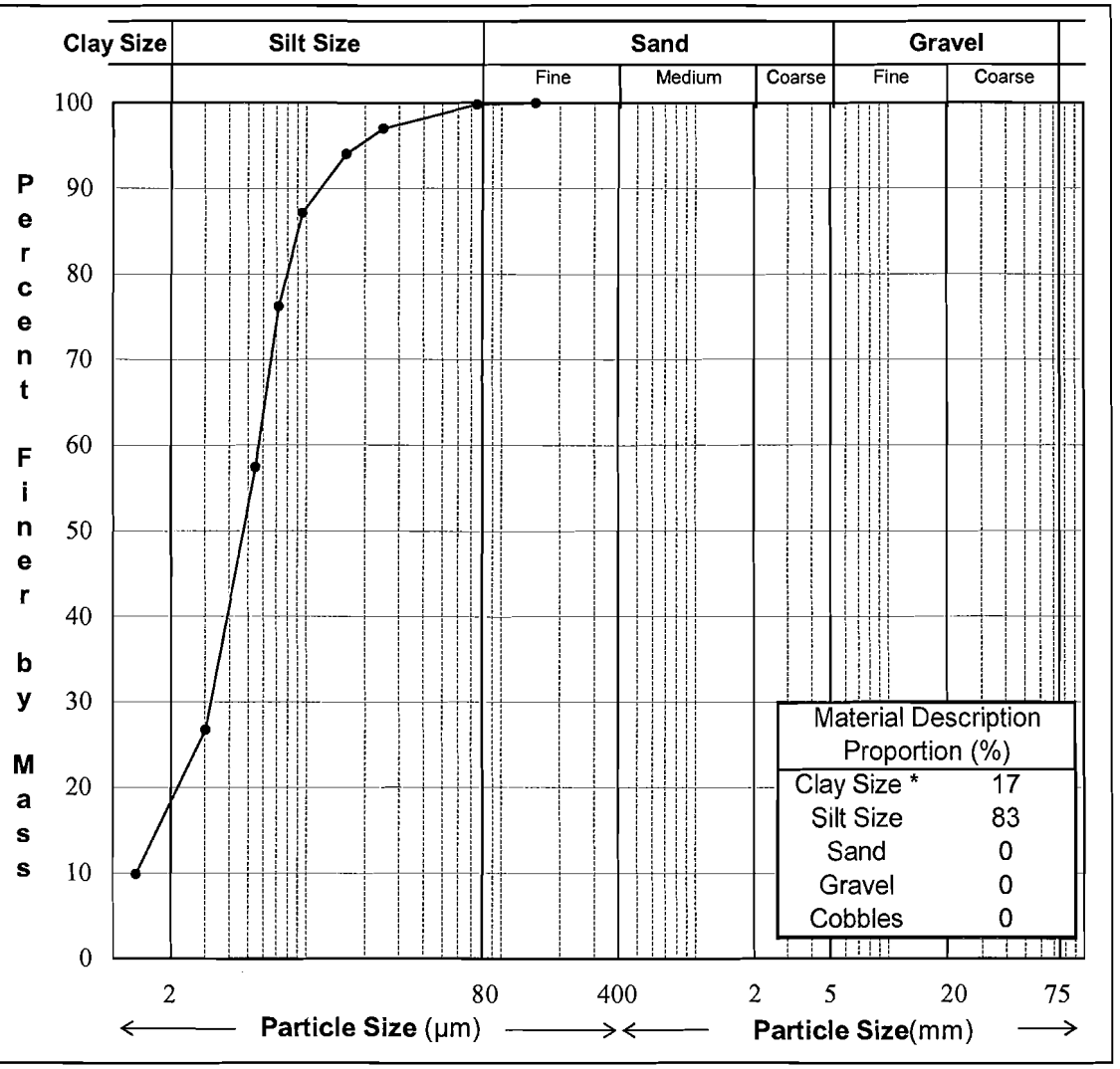
LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/9/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/09
Client: AECOM
Project No.: W14101171
Location:
Sample No.: BH07-3
Depth: 4.5 m
Description**: SILT - some clay

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	
850 µm	
425 µm	
250 µm	
150 µm	100
75 µm	100
25 µm	97
16 µm	94
10 µm	87
7 µm	76
5 µm	57
3 µm	27
1 µm	10



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH08
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6737347N; 494293E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) SILT (%) SAND (%) GRAVEL (%) 20 40 60 80	Depth (ft)
0	SAND - some silt, fine grained, uniform, dry to damp below seasonal frost, loose, medium brown		1				0
1							
	SILT AND SAND - trace organics, damp, firm, brown - interbedded with sandier material		2				5
2							
			3				10
3	SILT - trace fine sand, trace to some clay, wet and softer with depth, olive grey with some brown mottling						
4			4				15
5	- soft and dark grey below 5 m						
			5				20
6	END OF BOREHOLE @ 6.0 m						
7							25
8							
9							30
10							33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/9/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 10, 2008

Tespit Number: BH08-2

Depth: 1.5 m

Soil Description: SILT AND SAND

Cu:

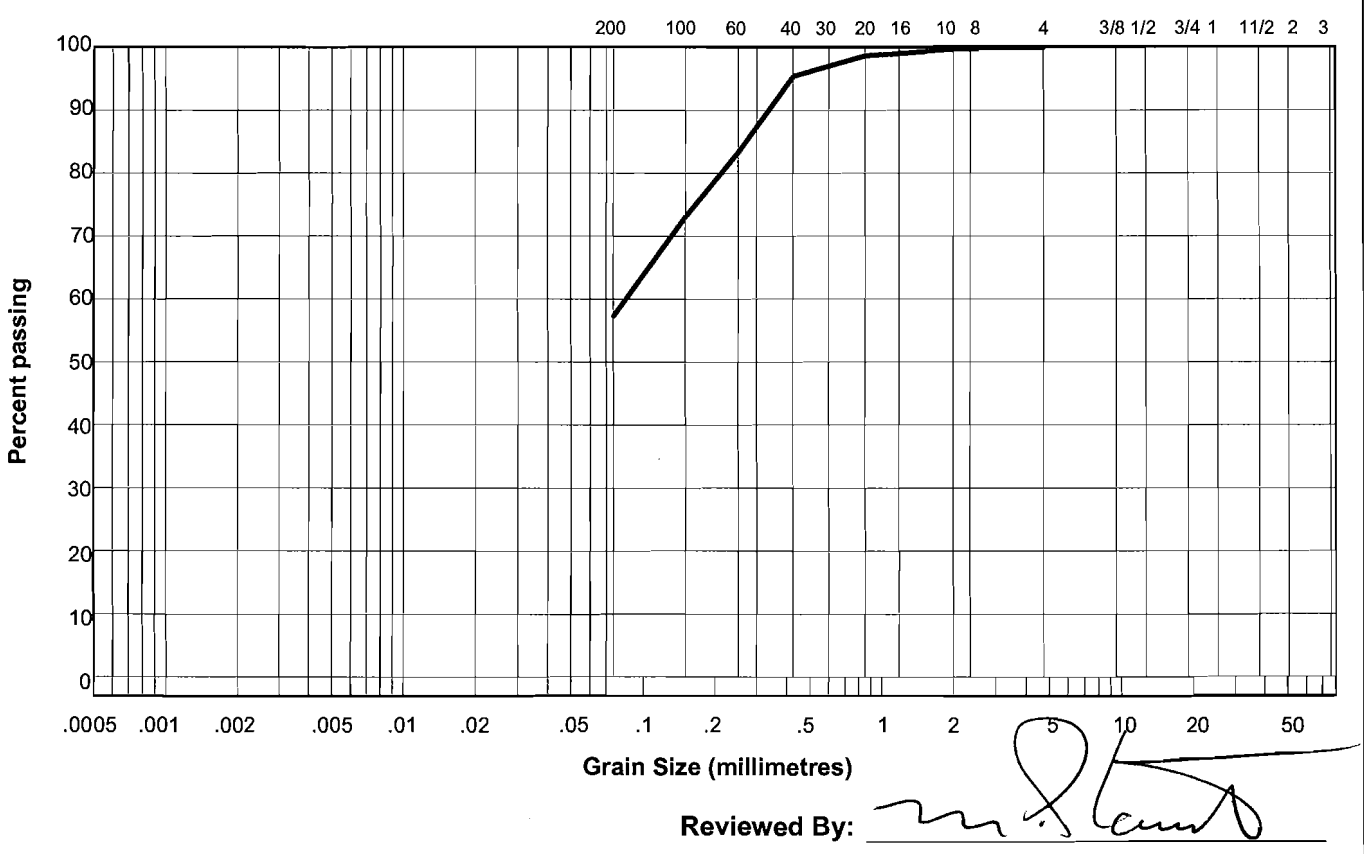
Cc:

Natural Moisture Content: 17.0%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	100
2.000	100
0.850	99
0.425	95
0.250	83
0.150	73
0.075	57.3

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH09
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6737534N; 494167E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SAND - trace to some silt, trace organics, fine grained, uniform, damp to dry below frost, loose, dark brown		1	
1				
			2	
2	- slightly coarser and grey below 2.0 m			
			3	
3	- becomes siltier and firm, moisture increasing below 3.0 m			
4			4	
	SILT - some clay, trace fine sand, wet, soft, dark grey			
5				
			5	
6	END OF BOREHOLE @ 6.0 m			
7				
8				
9				
10				

Bulk Density(kg/m^3): 500 1000 1500 2000

PLASTIC M.C. LIQUID: 20 40 60 80

CLAY (%): 20 40 60 80

SILT (%): 20 40 60 80

SAND (%): 20 40 60 80

GRAVEL (%): 20 40 60 80

Depth (ft): 0 5 10 15 20 25 30 33

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LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/9/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 10, 2008

Tespit Number: BH09-1

Depth: 0.3 m

Soil Description: SAND - silty, trace gravel

Cu:

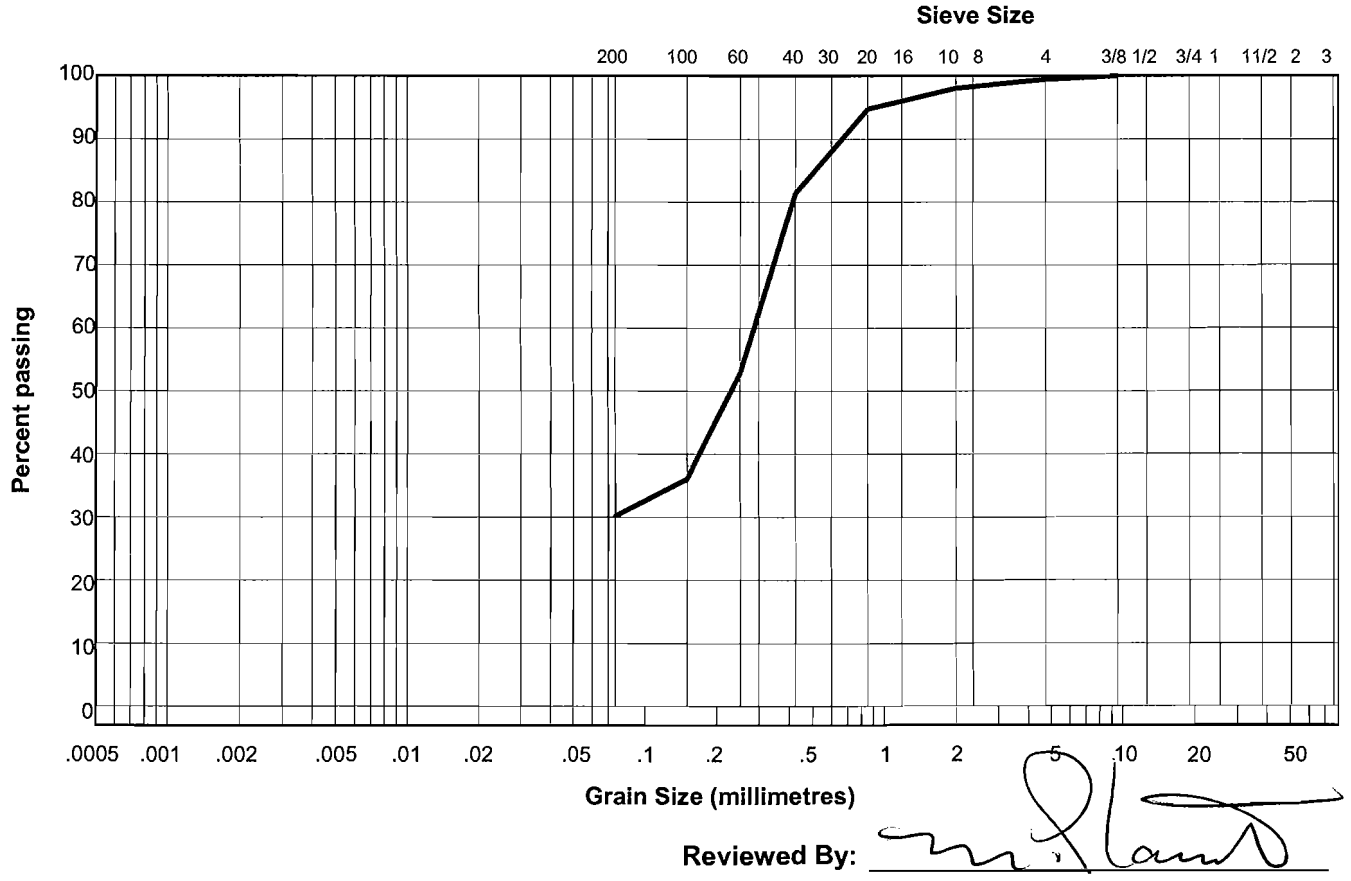
Cc:

Natural Moisture Content: 9.2%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	100
4.750	99
2.000	98
0.850	95
0.425	81
0.250	53
0.150	36
0.075	30.2

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH10
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6737740N; 494593E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Depth (ft)
0	SILT - some clay, trace of fine sand, seasonally frozen to 0.6 m, moist, below frost firm, medium olive brown, some mottling		1				0
1							
			2				5
2							
			3				10
3	- moisture content increasing with depth, firm, dark olive						
4			4				15
	- consistently smooth drilling throughout depth of borehole, wet with higher plasticity from 4.5 to 6.0 m						
5			5				
6	END OF BOREHOLE @ 6.0 m						20
7							25
8							
9							30
10							33

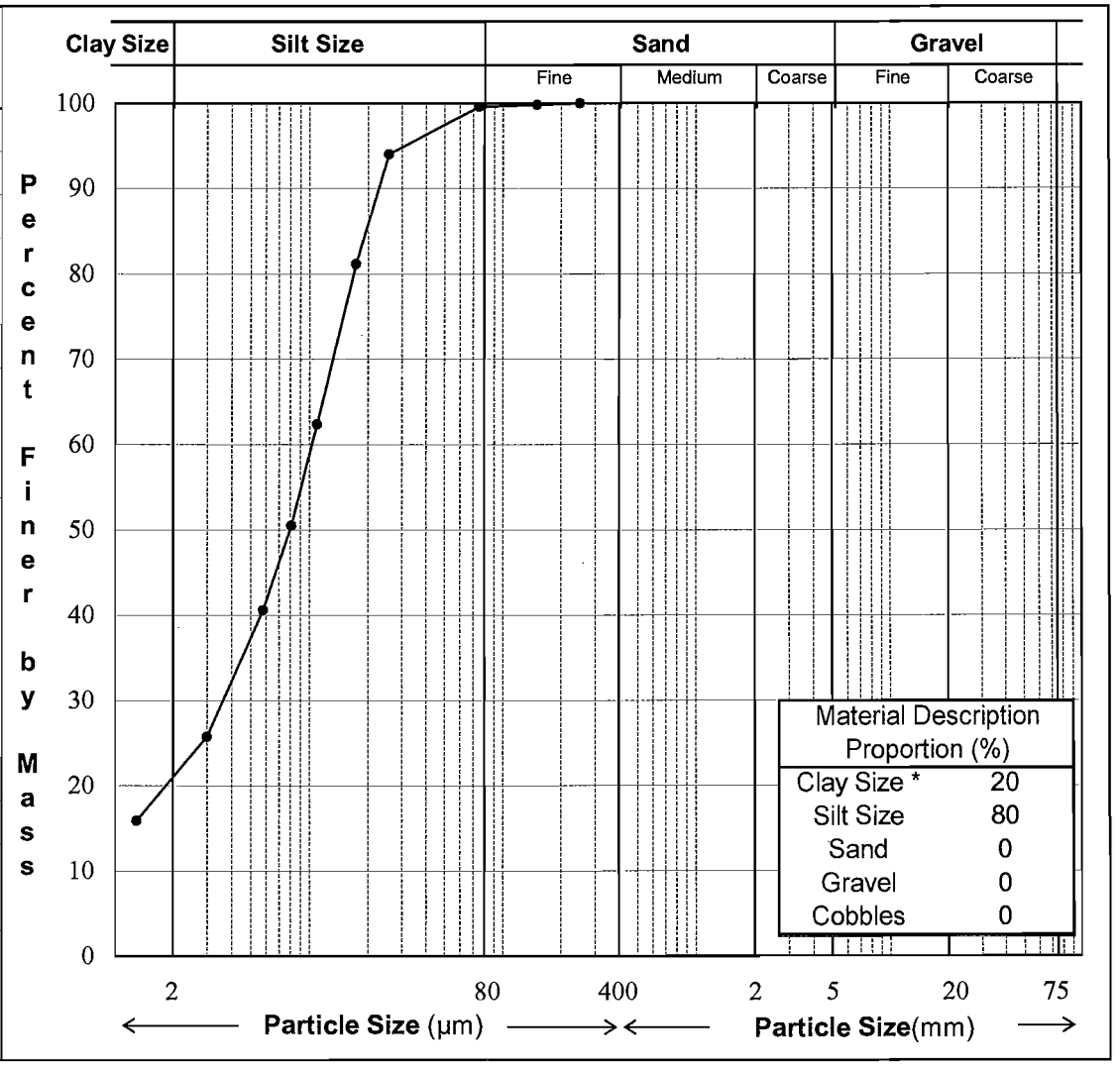
EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 6m
	REVIEWED BY:	COMPLETE: 12/10/2008
	DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/11
Client: AECOM
Project No.: W14101171
Location:
Sample No.: BH10-2
Depth: 1.5 m
Description**: SILT - some clay

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	
850 µm	
425 µm	
250 µm	100
150 µm	100
75 µm	100
26 µm	94
17 µm	81
11 µm	62
8 µm	50
6 µm	41
3 µm	26
1 µm	16



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By: _____

EBA Engineering Consultants Ltd. eba

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH11
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6737995N; 494583E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	GRAVEL (FILL) - sandy, trace to some silt, seasonally frozen, dark brown		1	
1	SAND - some silt to silty, fine grained, dry to damp, fairly compact, medium brown		2	
2	- sand is medium to coarse grained from 1.5 to 2.0 m			
3	SILT - some clay, trace fine sand, damp, becoming moist with depth, firm, medium to dark olive with some brown mottling		3	
4			4	
5			5	
6	END OF BOREHOLE @ 6.0 m			
7				
8				
9				
10				

Bulk Density(kg/m^3): 500 1000 1500 2000

PLASTIC M.C. LIQUID: 20 40 60 80

CLAY (%): 20 40 60 80

SILT (%): 20 40 60 80

SAND (%): 20 40 60 80

GRAVEL (%): 20 40 60 80

Depth (ft): 0 5 10 15 20 25 30 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/10/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 11, 2008

Tespit Number: BH11-2

Depth: 1.5 m

Soil Description: SAND - silty

Cu:

Cc:

Natural Moisture Content: 6.5%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	100
2.000	100
0.850	100
0.425	98
0.250	79
0.150	49
0.075	21.8

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse

Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH12
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6738445N; 494880E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	ORGANIC ROOT MATERIAL - frozen, black			
	SAND AND SILT - some silt to silty, fine grained, uniform, dry to damp, medium brown		1	
1	- becomes coarser, trace silt, dry, loose, greyish brown below 0.3 m			
	SILT -some fine sand, trace to some clay, damp, firm, light olive		2	
2				
3	- moisture content increases with depth, still firm, dark olive		3	
4	- finer below 4.0 m		4	
5				
6	END OF BOREHOLE @ 6.0 m		5	
7				
8				
9				
10				

Bulk Density(kg/m^3): 500 1000 1500 2000

PLASTIC M.C. LIQUID: 20 40 60 80

◆ CLAY (%) ◆: 20 40 60 80

● SILT (%) ●: 20 40 60 80

▲ SAND (%) ▲: 20 40 60 80

■ GRAVEL (%) ■: 20 40 60 80

Depth (ft): 0 5 10 15 20 25 30 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/10/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 10, 2008

Tespit Number: BH12-1

Depth: 0.3 m

Soil Description: SAND AND SILT

Cu:

Cc:

Natural Moisture Content: 4.5%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	100
2.000	100
0.850	100
0.425	95
0.250	77
0.150	61
0.075	47.7

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse

Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH13
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6738509N; 494430E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Depth (ft)
0	ORGANIC ROOT MATERIAL - seasonally frozen, brown and black				0
	SAND - silty, trace organics at upper interface, fine grained, uniform, damp below seasonal frost, medium brown		1		
1	- sand becomes slightly coarser, trace silt, dry to damp, medium greyish brown				
			2		5
	- trace to some gravel from 1.5 to 2.5 m				
2					
	SILT - some clay, trace fine sand, damp, firm, light olive		3		10
3	- moisture content increases with depth, firm, becomes dark olive				
4			4		15
5	- easy drilling throughout depth of borehole				
			5		
6	END OF BOREHOLE @ 6.0 m				20
7					
8					25
9					30
10					33

Bulk Density(kg/m^3) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80

◆ CLAY (%) ◆ 20 40 60 80

● SILT (%) ● 20 40 60 80

▲ SAND (%) ▲ 20 40 60 80

■ GRAVEL (%) ■ 20 40 60 80

EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 6m
	REVIEWED BY:	COMPLETE: 12/10/2008
	DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 11, 2008

Tespit Number: BH13-2

Depth: 1.5 m

Soil Description: SAND - silty

Cu:

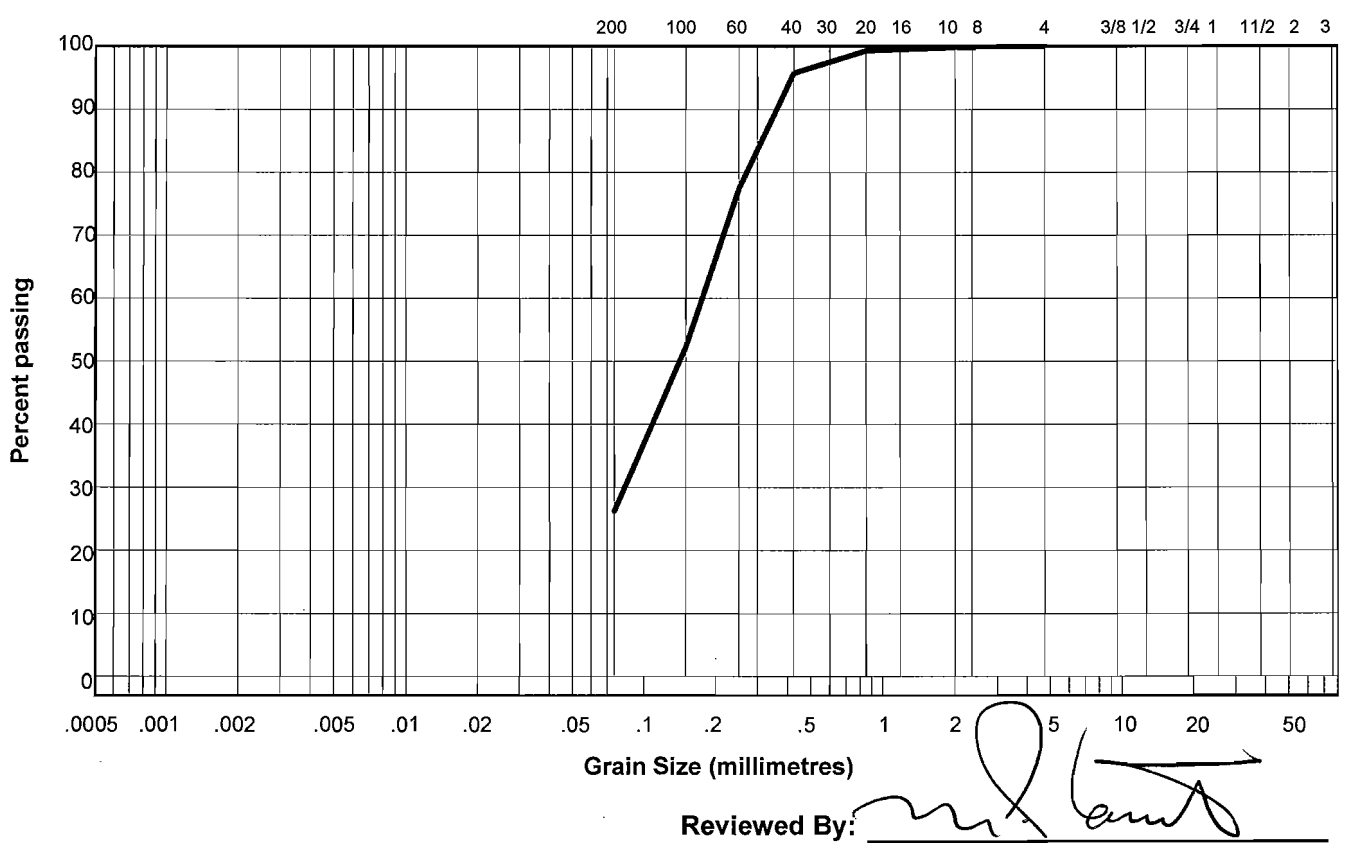
Cc:

Natural Moisture Content: 3.2%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	100
2.000	100
0.850	99
0.425	96
0.250	77
0.150	52
0.075	26.2

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

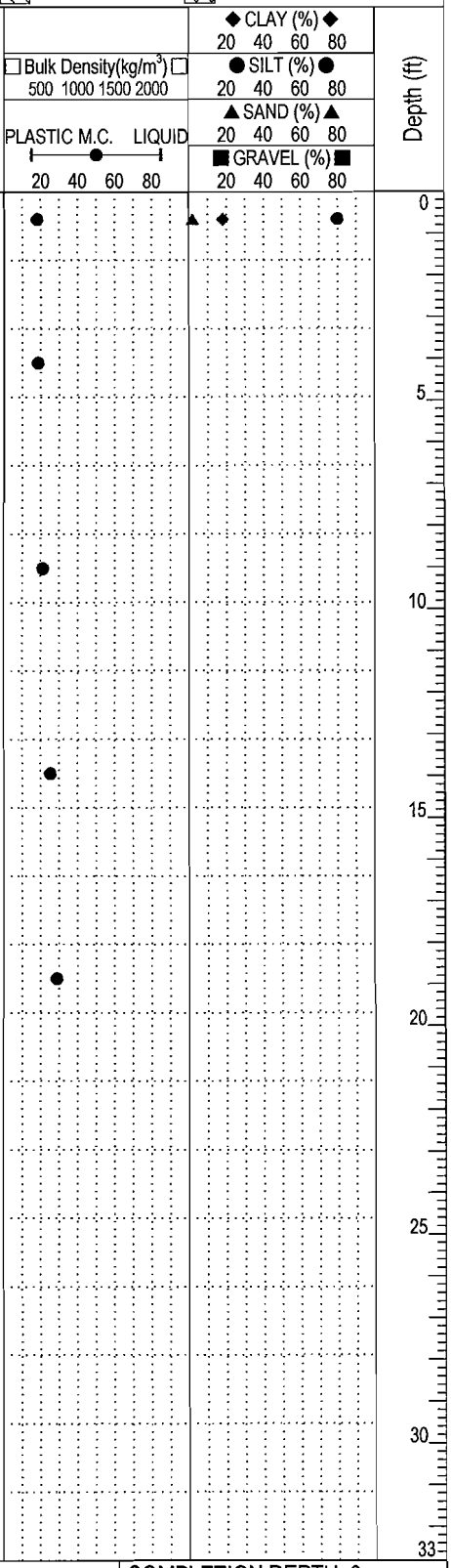
EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH14
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6738205N; 494192E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	ORGANIC ROOT MATERIAL - seasonally frozen, black			
	SILT - some clay, trace fine sand, seasonally frozen to 0.8 m, damp below seasonal frost, firm, medium olive brown		1	
1				
			2	
2				
	- moisture content increases with depth, firm, dark olive brown		3	
3				
4			4	
	- soft by 4.5 m, turning dark grey as moisture content increases between 4.5 and 6.0 m			
5				
			5	
6	END OF BOREHOLE @ 6.0 m			
7				
8				
9				
10				



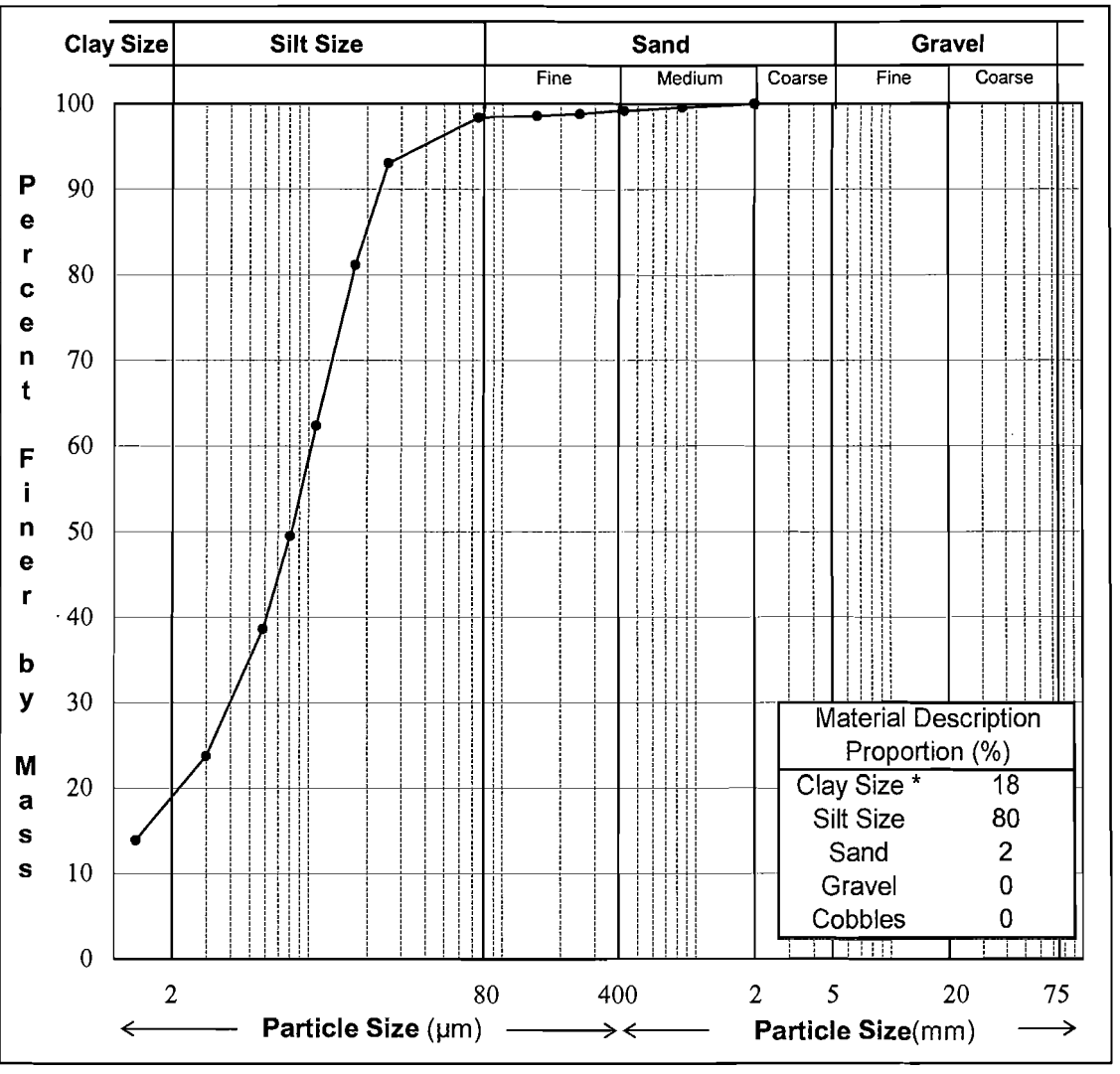
EBA Engineering Consultants Ltd.	LOGGED BY: MCP	COMPLETION DEPTH: 6m
	REVIEWED BY:	COMPLETE: 12/10/2008
	DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/11
Client: AECOM
Project No.: W14101171
Location:
Sample No.: BH14-1
Depth: 0.3 m
Description**: SILT - some clay, trace sand

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 µm	100
425 µm	99
250 µm	99
150 µm	99
75 µm	98
26 µm	93
17 µm	81
11 µm	62
8 µm	50
6 µm	39
3 µm	24
1 µm	14



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By: _____

EBA Engineering Consultants Ltd. eba

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH15
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6738162N; 494003E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SAND - some to trace silt, fine grained, uniform, dry to damp below seasonal frost, medium brown		1	
	- becomes cleaner and greyish brown at 0.3 m			
1			2	
2				
3	- smooth, easy drilling throughout depth of borehole		3	
4			4	
5				
6			5	
7			6	
8				
9	SILT - some clay, trace fine sand, wet, soft, dark olive		7	
	END OF BOREHOLE @ 9.0 m			
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

CLAY (%) 20 40 60 80

SILT (%) 20 40 60 80

SAND (%) 20 40 60 80

GRAVEL (%) 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 9m
REVIEWED BY:	COMPLETE: 12/10/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 11, 2008

Tespit Number: BH15-5

Depth: 6.0 m

Soil Description: SAND - trace silt

Cu: 2.4

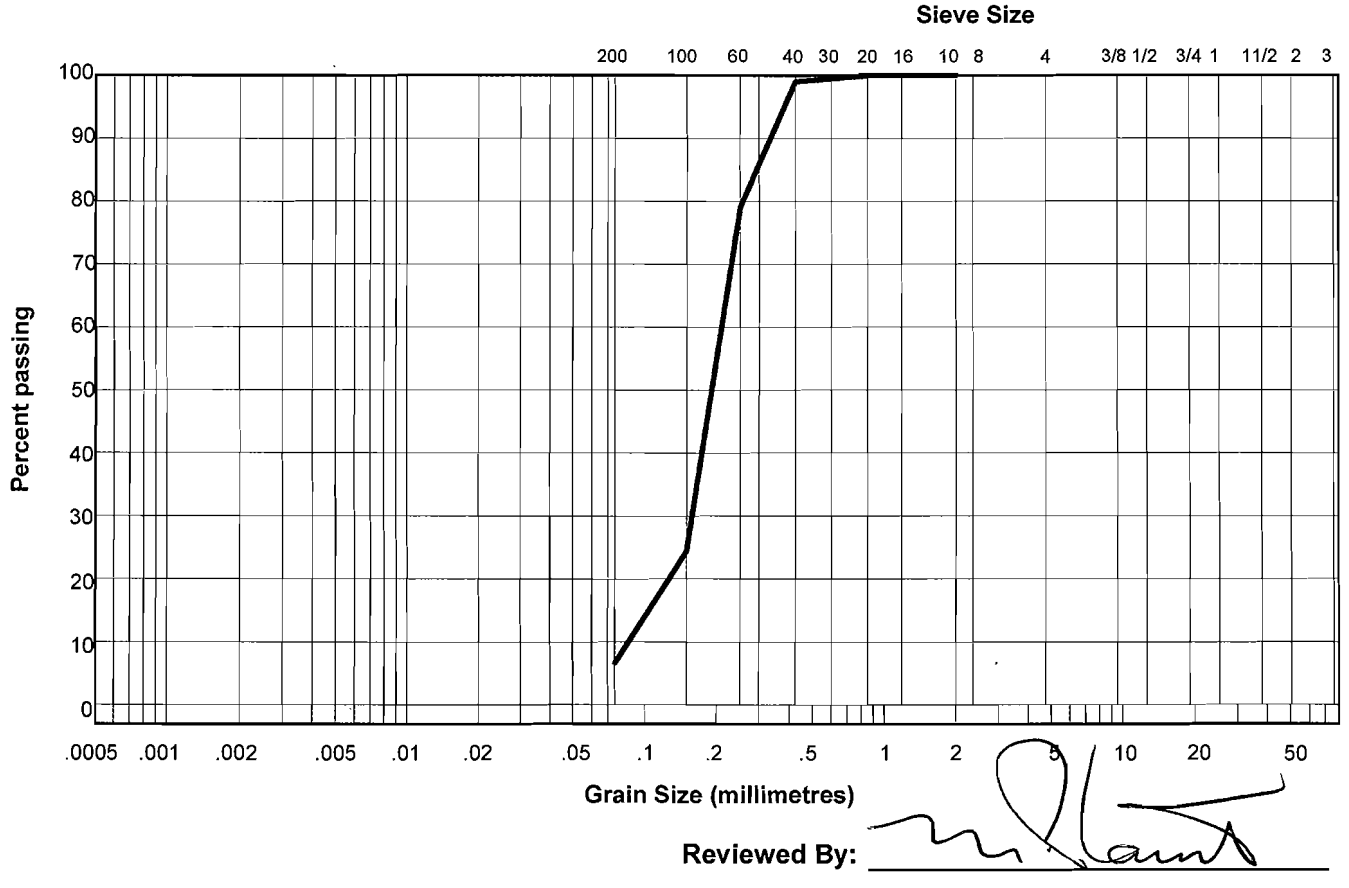
Cc: 1.4

Natural Moisture Content: 2.9%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	#N/A
2.000	100
0.850	100
0.425	99
0.250	79
0.150	24
0.075	6.6

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH16
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6738800N; 493653E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	ORGANIC ROOT MATERIAL - seasonally frozen, organic brown			
	SAND - some silt to silty, damp below seasonal frost, dark brown		1	
1	- becomes clean and medium to fine grained, dry to damp, medium greyish brown			
	SILT - some clay, trace fine sand, damp, firm, light olive		2	
2				
3	- moisture content increases with depth, still firm		3	
4			4	
	- some mottling in soil at 4.5 m			
5				
6			5	
	END OF BOREHOLE @ 6.0 m			
7				
8				
9				
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

CLAY (%) 20 40 60 80

SILT (%) 20 40 60 80

SAND (%) 20 40 60 80

GRAVEL (%) 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/11/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 11, 2008

Tespit Number: BH16-1

Depth: 0.3 m

Soil Description: SAND - trace silt

Cu:

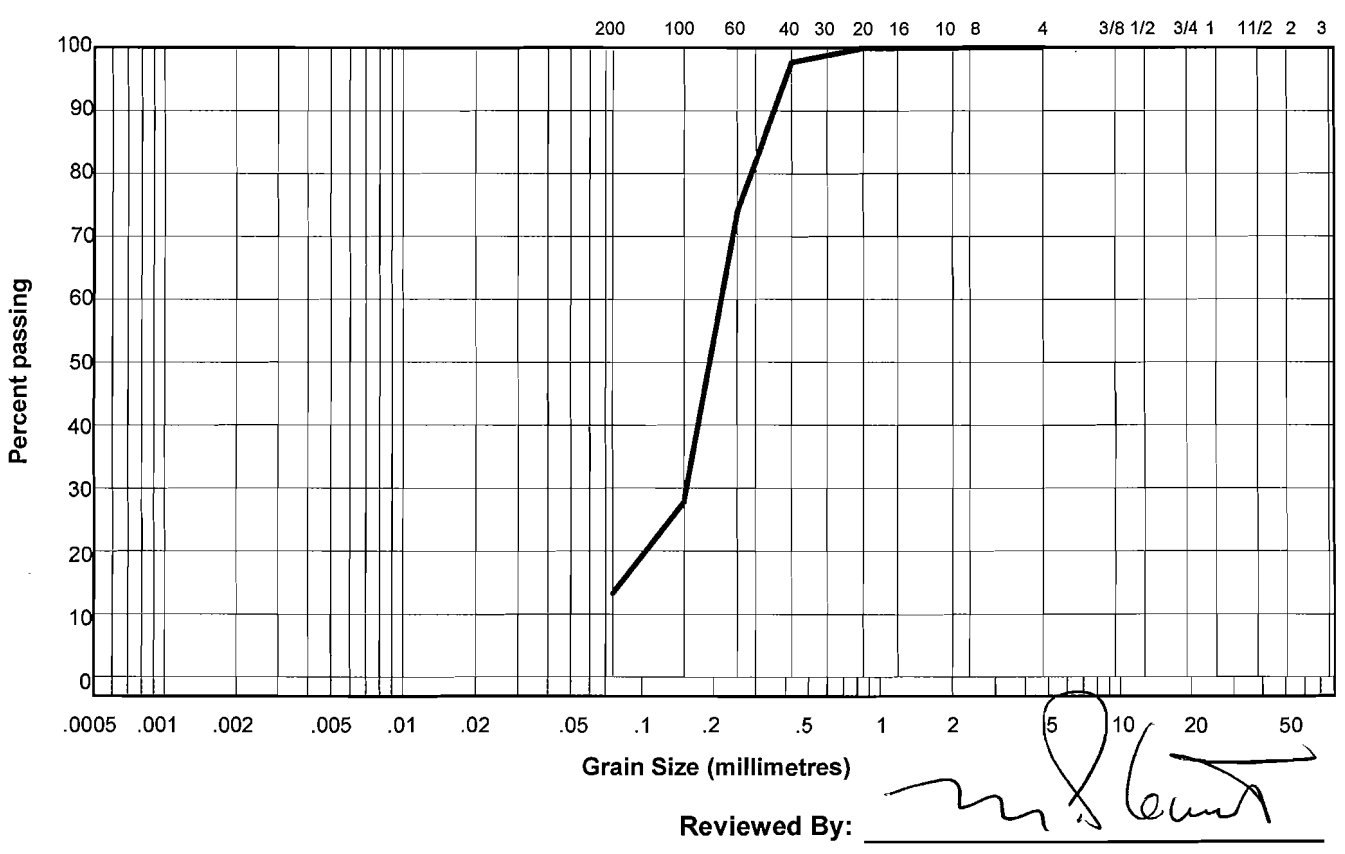
Cc:

Natural Moisture Content: 5.2%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	100
2.000	100
0.850	100
0.425	98
0.250	74
0.150	28
0.075	13.3

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH17
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6738516N; 493694E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	ORGANIC ROOT MATERIAL - seasonally frozen, black and brown			
	SAND - some silt, trace organics, damp below seasonal frost, brown		1	
	- becomes SAND - trace silt, medium to fine grained, damp, greyish brown			
	SILT - some clay, trace fine sand, damp, firm, medium olive brown			
1			2	
2	- moisture content increasing with depth, becoming softer			
3			3	
4	- sandy, silt lens from 4.1 to 4.3 m		4	
5				
6			5	
	END OF BOREHOLE @ 6.0 m			
7				
8				
9				
10				

Bulk Density(kg/m^3): 500 1000 1500 2000

PLASTIC M.C. LIQUID: 20 40 60 80

CLAY (%): 20 40 60 80

SILT (%): 20 40 60 80

SAND (%): 20 40 60 80

GRAVEL (%): 20 40 60 80

Depth (ft): 0 5 10 15 20 25 30 33

EBA Engineering Consultants Ltd.

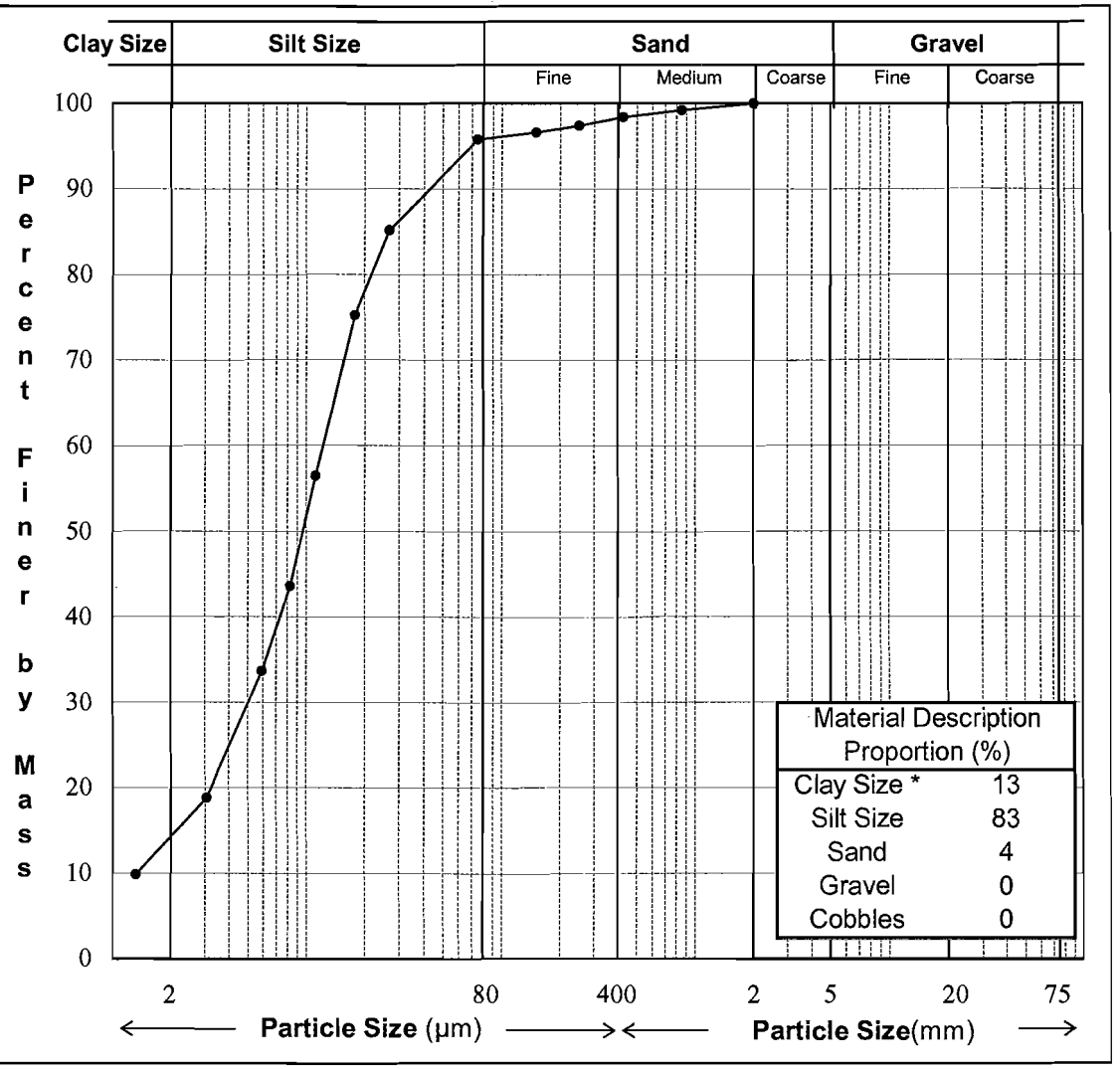
LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/11/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/11
Client: AECOM
Project No.: W14101171
Location:
Sample No.: BH17-3
Depth: 3.0 m
Description**: SILT - some clay, trace sand

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 µm	99
425 µm	98
250 µm	97
150 µm	97
75 µm	96
27 µm	85
18 µm	75
11 µm	56
8 µm	44
6 µm	34
3 µm	19
1 µm	10



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH18
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6738121N; 493750E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m³) 500 1000 1500 2000 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) / SILT (%) / SAND (%) / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC ROOT MATERIAL						0
	SAND AND SILT - rootlets throughout, seasonally frozen, organic brown		1				
1	SAND - some to trace silt, medium to fine grained, damp below frost, greyish brown						
	SILT - some clay, trace sand, damp, firm, light olive brown		2				5
2							
			3				10
3	- moisture content increases with depth						
4			4				15
	- becomes softer by 4.5 m color turns dark grey below 5.0 m						
5			5				
6	END OF BOREHOLE @ 6.0 m						20
7							25
8							
9							30
10							33

EBA Engineering Consultants Ltd.

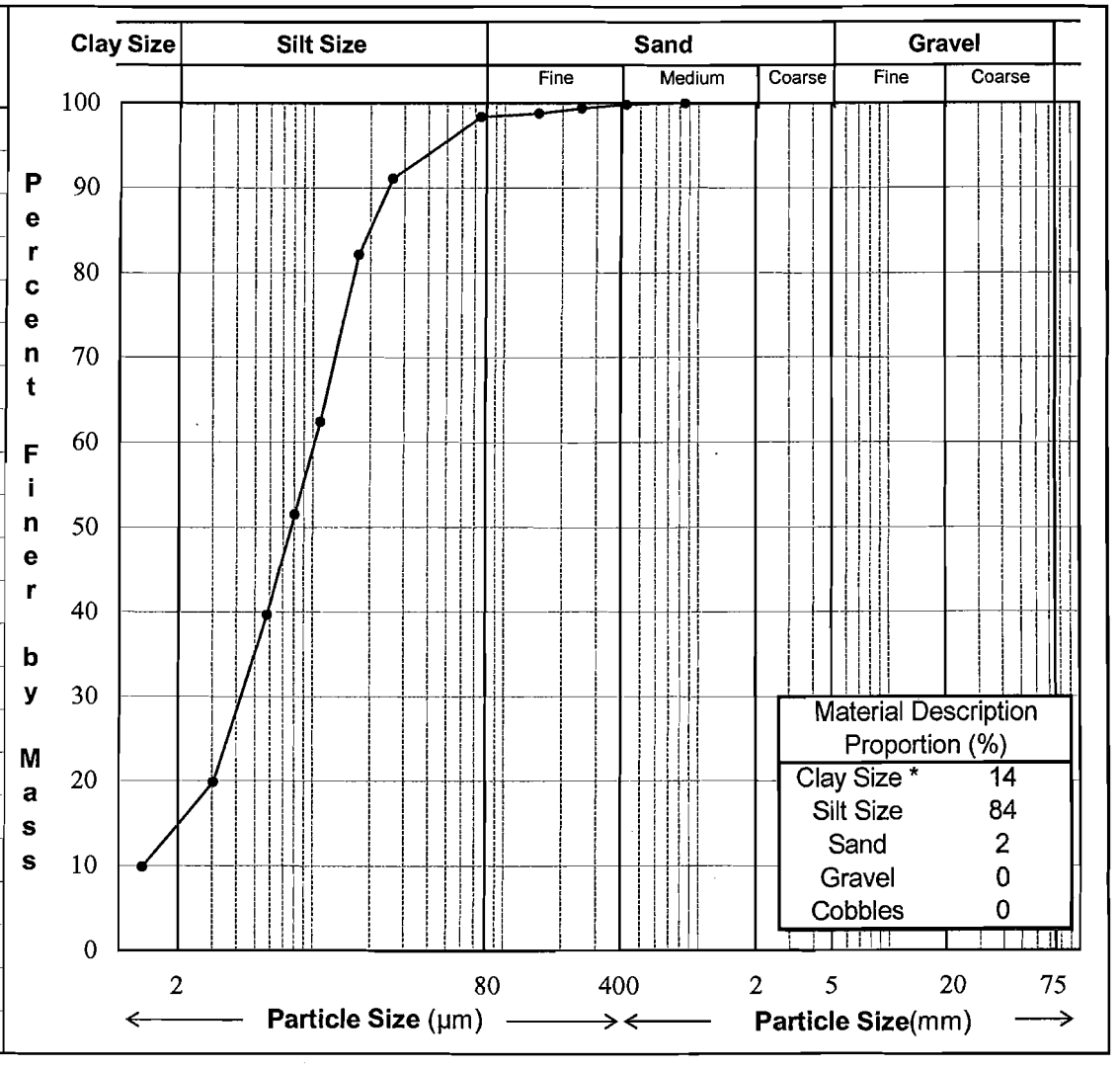
LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/11/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/11
Client: AECOM
Project No.: W14101171
Location:
Sample No.: BH18-2
Depth: 1.5 m
Description**: SILT - some clay, trace sand

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	
850 µm	100
425 µm	100
250 µm	99
150 µm	99
75 µm	98
26 µm	91
17 µm	82
11 µm	62
8 µm	51
6 µm	40
3 µm	20
1 µm	10



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By:

EBA Engineering Consultants Ltd. eba

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH19
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6737854N; 493739E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	SAND - some to trace silt, medium to fine grained, damp below seasonal frost, medium brown to greyish brown		1	
1				
2	SILT - some clay, trace fine sand, damp, firm, light olive brown		2	
3	- moisture increasing with depth, darker olive brown		3	
4			4	
5	- softer by 4.5 m, becoming dark olive to grey in colour			
6			5	
	END OF BOREHOLE @ 6.0 m			
7				
8				
9				
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

◆ CLAY (%) ◆ 20 40 60 80

● SILT (%) ● 20 40 60 80

▲ SAND (%) ▲ 20 40 60 80

■ GRAVEL (%) ■ 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 12/11/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 11, 2008

Tespit Number: BH19-1

Depth: 0.3 m

Soil Description: SAND - some silt

Cu:

Cc:

Natural Moisture Content: 6.0%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	100
2.000	100
0.850	100
0.425	90
0.250	60
0.150	37
0.075	18.1

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse

Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	AECOM	BOREHOLE NO: W14101171-BH20
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT NO: W14101171
Whitehorse, YT	6739080N; 493450E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Bulk Density(kg/m^3) 500 1000 1500 2000; PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80; SILT (%) 20 40 60 80; SAND (%) 20 40 60 80; GRAVEL (%) 20 40 60 80	Depth (ft)
0	SILT (FILL) on top of cleared area						0
	SAND - some to trace silt, medium to fine grained, damp below seasonal frost, fairly compact, medium brown to greyish brown		1				
1							
			2				5
2							
	SILT - some clay, trace fine sand, moist to wet, firm, becoming softer by 3.0 m, dark olive brown, trace mottling						
			3				10
3							
4			4				15
5							
			5				20
6							
7			6				25
	END OF BOREHOLE @ 7.5 m						
8							
9							30
10							33

EBA Engineering Consultants Ltd.

LOGGED BY: MCP	COMPLETION DEPTH: 7.5m
REVIEWED BY:	COMPLETE: 12/11/2008
DRAWING NO:	Page 1 of 1

PARTICLE SIZE DISTRIBUTION

ASTM C136 & D422

Project: **Whistle Bend Subdivision, Whitehorse, YT**

Project Number: W14101171

Date Tested: December 11, 2008

Tespit Number: BH20-2

Depth: 1.5 m

Soil Description: SAND - trace silt

Cu: 2.8

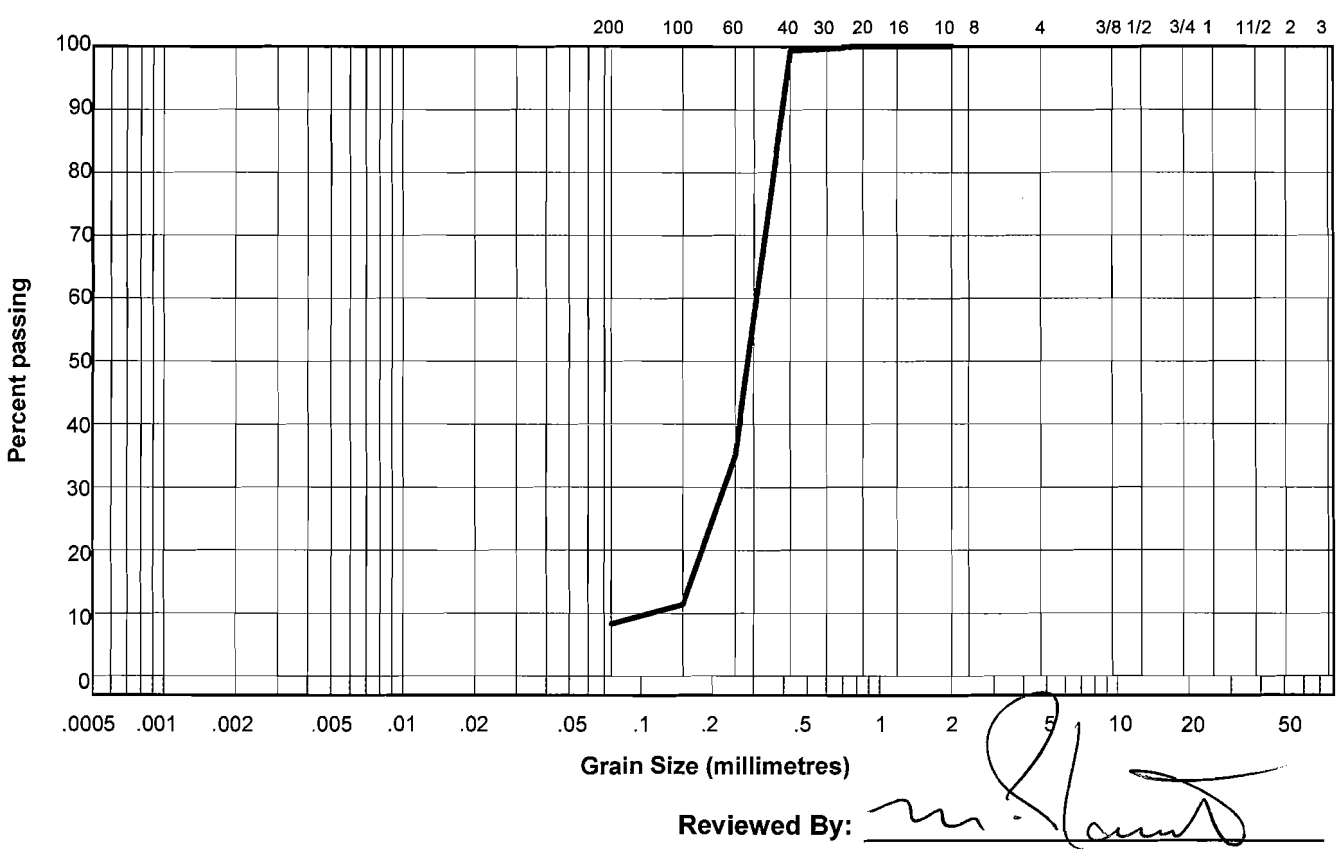
Cc: 1.5

Natural Moisture Content: 3.3%

Remarks:

Sieve Size	Percent Passing
50.000	#N/A
37.500	#N/A
25.000	#N/A
19.000	#N/A
12.500	#N/A
9.500	#N/A
4.750	#N/A
2.000	100
0.850	100
0.425	99
0.250	35
0.150	11
0.075	8.3

Clay	Silt	Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



Reviewed By:

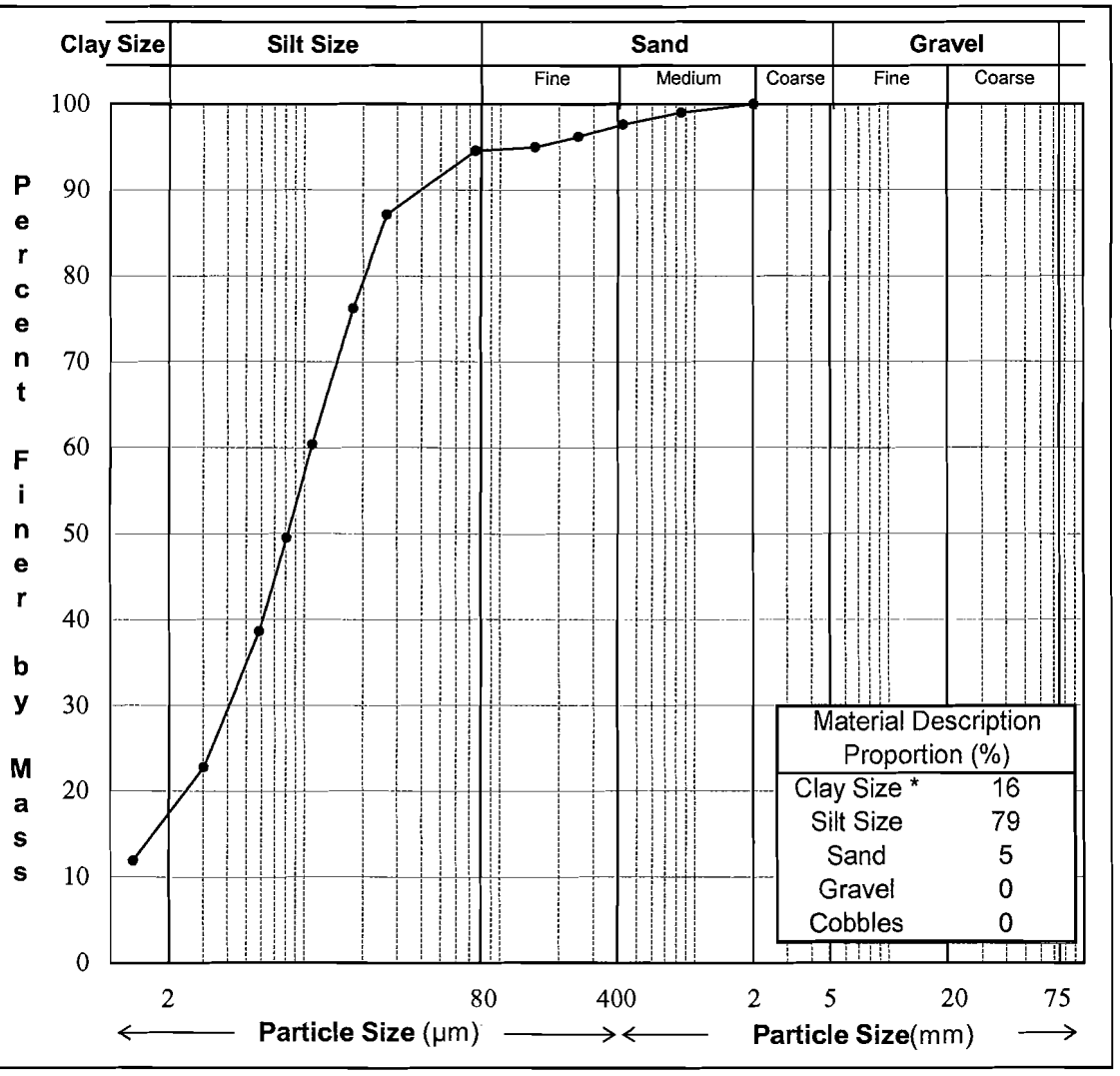
EBA Engineering Consultants Ltd.

PARTICLE SIZE ANALYSIS (Hydrometer) TEST REPORT

ASTM D422

Project: **Whistle Bend Subdivision, Whitehorse, YT** Date Tested: 2008/12/09
Client: AECOM
Project No.: W14101171
Location:
Sample No.: BH20-4
Depth: 4.5 m
Description**: SILT - some clay, trace sand

Particle Size	Percent Passing
100 mm	
75 mm	
50 mm	
38 mm	
25 mm	
19 mm	
13 mm	
10 mm	
5 mm	
2 mm	100
850 µm	99
425 µm	98
250 µm	96
150 µm	95
75 µm	95
27 µm	87
18 µm	76
11 µm	60
8 µm	50
6 µm	39
3 µm	23
1 µm	12



Remarks: * The upper clay size of 2 µm, per the Canadian Foundation Engineering Manual.
** The description is visually based & subject to EBA description protocols.

Reviewed By:

EBA Engineering Consultants Ltd.

Geotechnical Evaluation	Client: AECOM	TESTPIT NO: W14101171-TP21
Whistle Bend Subdivision	Excavator: Hitachi Tracked	PROJECT NO: W14101171
Whitehorse, YT	6739182N; 494917E; Zone 8	

SAMPLE TYPE: GRAB SAMPLE | NO RECOVERY | BULK | CRREL CORE | SHELBY TUBE | GRAB CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	LITHOLOGICAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS
0	GRASS GROUND COVER AND ORGANICS - rootlets throughout, seasonally frozen to 0.5 m, black			Seasonal Frost to 0.5 m
1	SAND - silty, interbedded with organics, medium to fine grained, moist to wet, dark grey		1	Unfrozen below 0.5 m
2			2	
2	SILT - trace clay, trace fine sand, deposited in even, parallel laminae (glaciolacustrine), wet, soft, dark brown			
3	- becomes dark grey in colour (unoxidized) below 3.0 m		3	
4	SAND - trace to some silt, medium to fine grained and siltier below 5.0 m, wet to saturated with water entering testpit around 5.0 m, very loose, testpit sloughing badly, dark grey		4	
5				
6			5	
6	END OF TESTPIT @ 6.0 m			
7	NOTE: testpit excavated in large kettle depression located west of golf course			
8				
9				
10				

Bulk Density(kg/m^3) 500 1000 1500 2000

PLASTIC M.C. LIQUID 20 40 60 80

CLAY (%) 20 40 60 80

SILT (%) 20 40 60 80

SAND (%) 20 40 60 80

GRAVEL (%) 20 40 60 80

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

EBA Engineering Consultants Ltd.

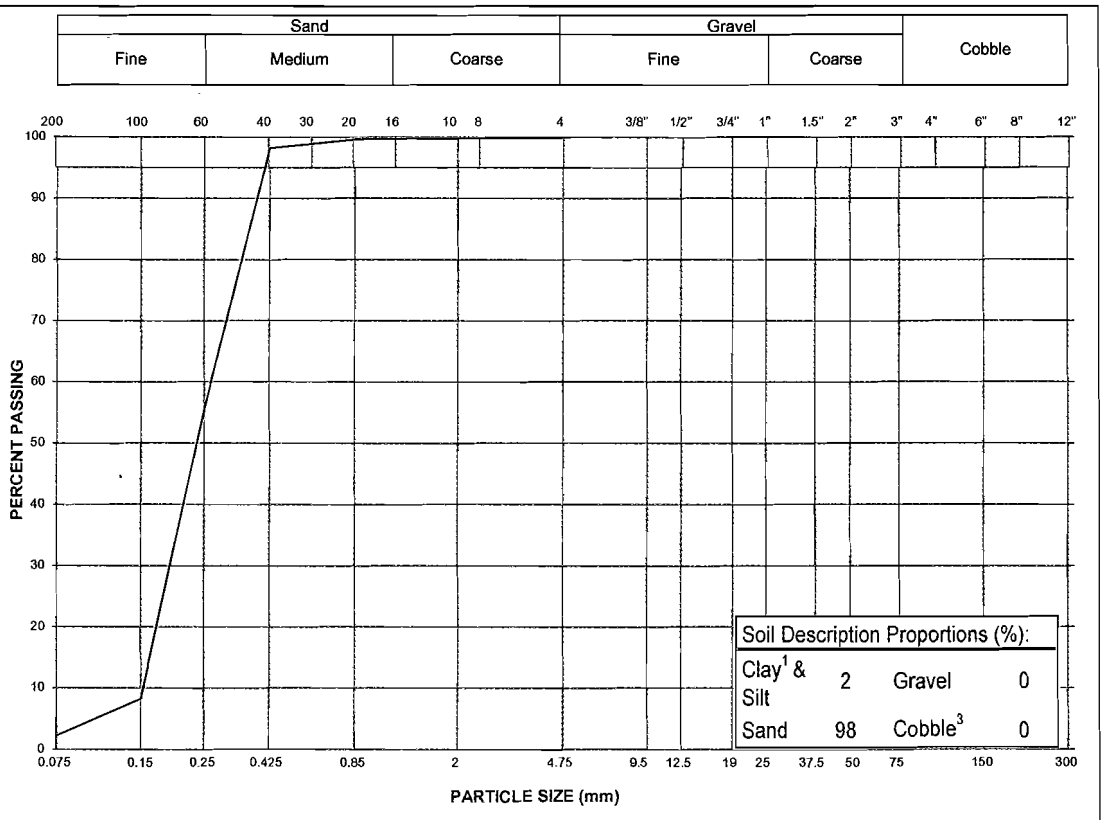
LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 3/24/2009
DRAWING NO:	Page 1 of 1

PARTICLE SIZE ANALYSIS TEST REPORT

ASTM D422 & C136

Project:	Whistlebend Subdivision	Client:	AECOM
Project No.:	W14101171	Client Rep.:	
Site:	Kettle Depression		
Material Type:		Date Tested:	27-Mar-2009 By: MCP
Sample No.:		Soil Description[2]:	SAND - trace silt
Sample Loc.:	W14101171-TP21		
Sample Depth:	4.0 m	USC Classification:	SM Cu: 1.7
Sampling Method:	Grab		Cc: 0.9
Date sampled:	24-Mar-2009 By: MCP	Moisture Content:	21.7

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	
12.5	
10	
5	100.0
2	99.8
0.85	99.7
0.425	98.2
0.25	55.6
0.15	8.3
0.075	2.2



Notes:

[1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to EBA description protocols

[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification: _____

Remarks: _____

Reviewed By: _____

EBA Engineering Consultants Ltd. eba

TETRA TECH

April 11, 2017

ISSUED FOR USE
FILE: W14103567-18.004
Via Email: laura.prentice@gov.yk.ca

Government of Yukon
Department of Community Services
Land Development Branch
Box 2703
Whitehorse, YT Y1A 2C6

Attention: Laura Prentice- A/SeniorProject Manager

Subject: Lot Development and Foundation Design Assessment
Whistle Bend Subdivision Phase 3C Design Bulletin, Whitehorse, YT

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Government of Yukon (YG), Department of Community Services to provide geotechnical recommendations pertaining to foundation design for Phase 3C of the Whistle Bend Subdivision, Whitehorse, YT. This work follows Tetra Tech's proposal dated September 2, 2016.

2.0 SCOPE OF SERVICE

The scope of services includes the following:

- Describing site and soil conditions that may affect surface and subsurface drainage;
- Outlining appropriate methods of controlling surface water flow and disposal;
- Assessing potential for water problems to occur along with the provision of recommendations for prevention and mitigation of drainage problems; and,
- Providing foundation insulation recommendations for use during residential and commercial construction.

Appropriate sections and clauses in CAN/CSA S406-92, NBCC, and City of Whitehorse Servicing Standards Manual specifications shall be referenced.

3.0 PHASE 3C SITE CONDITIONS

3.1 Location and Development To Date

Phase 3C extends south inside the Casca Boulevard right-of-way. It extends south to Leotta Street for the area west of Goodard Way and the eastern boundary is the bio swale that runs north of Keno Way.

Proposed development throughout Phase 3C includes lots for multi-family housing, tri-plex and quad-plex structures; single family dwellings and a public service lot located along the east side of Goodard Way.

Tetra Tech Canada Inc.
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The Phase 3C area is currently undeveloped. Clearing has been completed but stripping and grubbing will be completed in advance of pregrading, deep utility installation and roadway construction throughout 2017.

3.2 Phase 3C General Soil Conditions

Significant thicknesses of medium and/or medium to fine grained sand was noted during the December 2016 and March 2017 testpitting programs throughout the central and western portion of Sybill Circle in Phase 3C.

Shallow glaciolacustrine silt was encountered along the east portion of the site (lots east of Goodard Way and Olive May Way, including the lots on the south side of Sybill Circle next to the bio swale.

The logs for all testholes advanced throughout Phase 3C are attached to this letter report.

3.3 Groundwater

Deep boreholes were drilled in the vicinity of Phase 3C during the final design stages of Phase 1 and 2. Three boreholes (W14101372-BH01 at the water recirculation pump house site on Casca Boulevard; W14101372-BH02 at the sewage lift station site on Keno Way; and W14101500-BH01 which was drilled along the Porter Creek Sewage Lagoon access road (this is on the west side of the Phase 4 area)), were all drilled to a termination depth of 10 m. Groundwater was not noted in the three boreholes and subsequent monitoring or construction has suggested that groundwater should not affect conventional shallow foundation construction.

4.0 SITE GRADING AND DRAINAGE RECOMMENDATIONS

Review of the Associated Engineering Surface Works Pregrading Plan for Phase 3C (Drawing Number 2183-03-C-0004) confirms that once site grading is complete (assuming all fill placed is select sand to ensure non-frost susceptible conditions for foundation construction), the following site conditions will exist:

- Near surface glaciolacustrine silt will be encountered throughout lots 408 to 420 along Olive May Way; lot 538 (institutional) and lot 542 (park) along Goodard Way; and lots 346 (PUL) and single family lots 474 to 482 (possibly lots 483 and 529 as well);
- Much of multi-family lots 533 and 534, as well the entire lot 506 will be underlain by sand; and,
- Single family lots 484 to 528 at the north portion of Phase 3C will be underlain by sand once pregrading has been completed.

After site grading is complete, there will be potential for surface water and roof runoff disposal by infiltration into the surficial sand soils throughout the north and west portions of Phase 3C. However, potential for rock pit construction throughout the lots underlain by shallow glaciolacustrine silt will be minimal to non-existent; therefore, storm and surface water discharge on these lots should be directed over hardscape, onto paved roadways and into the storm sewer/bio swale system.

As well, it is important that all final site grading around commercial and residential structures direct water (roof run-off and surface water) away from the foundation elements to minimize potential for frost heave damage.

5.0 FOUNDATION RECOMMENDATIONS

According to the City of Whitehorse Building Advisory October 25, 2010, *Drainage Standards for Building Foundations*, any new building constructed in Whitehorse with below grade foundations must adhere to prescribed standards for drainage. The relevant standards referenced in the City of Whitehorse document include the following:

- Permanent Wood Foundations, as outlined in CAN/CSA S-406-92, Construction of Preserved Wood Foundations and identified in the 2005 edition of the National Building Code of Canada (NBCC 2005).
- Concrete Foundations, as described in NBCC 2005, Section 9.14, which identifies minimum requirements for foundation drainage, drainage tile and associated piping, granular drainage layers, drainage disposal, and control of surface runoff.

The prescriptive measures are based on CSA and NBC specifications as summarized in the following sections.

5.1 Permanent (Preserved) Wood Foundation Recommendations

If the use of permanent (preserved) wood foundations (PWF) is desired, a granular drainage layer should be installed beneath all footings and basement slabs, in accordance with CAN-CSA S406, because of the impervious glaciolacustrine underlying material. There are areas of free draining and non-free draining material throughout Phase 3C, therefore; there will be opportunity to waive the requirements in this standard as long as there is inspection and proper documentation by a geotechnical consultant qualified to perform visual soil classification.

The granular drainage layer should be constructed using a clean crushed stone or screened drain rock material of maximum particle size 40 mm and having less than 10% sand (passing the 5 mm sieve). This layer shall be at least 125 mm thick and shall extend beyond the footing plate a minimum of 300 mm. The granular drainage layer shall drain to a sump which, in turn, shall drain to a point of final disposal beyond the building's footprint. It is common to use bedding stone that is produced to satisfy the City of Whitehorse 25 mm Bedding Stone Specification. However, if alternative granular materials are being considered, testing can confirm suitability for use.

In accordance with CAN-CSA S406, the use of perimeter drainage tile or pipe is not recommended with PWF.

All backfill material placed within 600 mm of the foundation walls shall be free of deleterious debris, frozen materials, and boulders larger than 150 mm in diameter.

Existing site soils can be used as backfill around foundations and in service trenches. All backfill materials should be compacted to at least 95% of Standard Proctor Maximum Dry Density.

5.2 Concrete Foundation Recommendations

If the use of concrete foundations is desired, the drainage tile and pipe, granular drainage layers, drainage disposal and surface drainage specifications as per NBC 2005, Section 9.14 "Drainage" must be followed. As mentioned above, there will be areas of free draining and non-free draining material encountered throughout Phase 3C, therefore; there will be opportunity to waive the requirements in this standard as long as there is inspection and proper documentation by a geotechnical consultant qualified to perform visual soil classification.

Concrete footing and foundation wall systems are required to have perimeter drainage tile which terminates in a sump pit. A sump pit is to be installed to assist in the removal of water from the foundation area (should water accumulation in the sump pit warrant it).

6.0 FROST PENETRATION AND FROST HEAVE POTENTIAL

As mentioned above, the underlying glaciolacustrine silt is considered frost-susceptible. If there is less than 2.5 m of non-frost susceptible soil cover protecting the foundation, the following recommendations should be adhered to in order to provide sufficient protection from frost heave damage.

6.1 Foundation Insulation Recommendations

Current local codes now dictate the use of insulation around all foundations. However, the insulation thickness and distance out from the foundation elements are often considered to be insufficient when dealing with fine grained soils. Tetra Tech recommends insulating foundations constructed on frost susceptible soils to mitigate potential for seasonal frost-heave damage.

Typical insulation recommendations are shown on Figure 2, attached. Two foundation scenarios are presented including strip footings to support residential structures and a pad and pedestal configuration for foundations supporting entrance overhangs or rear decks.

It should be noted that the designs presented in Figure 2 is based on a foundation depth of 1.2 m. If different footing burial depths are being considered, Tetra Tech should be contacted to revise their insulation recommendations accordingly.

6.2 Foundation Construction On Frost Susceptible Soils

For frost heave to occur, three elements must be present, including:

- Cold temperatures that result in foundation soils that are below freezing;
- Frost susceptible soils such as the glaciolacustrine silts that have been noted throughout Phases 3D and 3E; and,
- Soil moisture contents that are high enough to support the formation of ice lenses.

Since it is impossible to control winter temperatures and it isn't practical to sub-excavate 2.5 m of fine grained soil under most structures, the soil moisture content becomes the single element that can be controlled by ensuring adequate perimeter insulation and control of surface water and roof runoff away from all foundation elements.

During foundation construction, it is critical that footings not be constructed on or over frozen ground and once the foundation is constructed, the underlying frost susceptible soils must be protected and not allowed to freeze.

7.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Government of Yukon and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Government of Yukon, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Tetra Tech's General Conditions are provided in Appendix A of this report.

8.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectively Submitted,
Tetra Tech Canada Inc.

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Attachments: Figure 1 – 3C: Site Plan Showing Existing Borehole and Testpit Locations
Figure 2: Foundation Insulation Details
Appendix A: Testhole Logs Specific To Phase 3C
Appendix B: Tetra Tech's General Conditions

FIGURES

W14101372-TP17
W14101171-BH13
W14101372-BH01
W14101500-BH02
W14101372-TP16
W14101372-TP03
W14101372-TP18
W14101372-TP19
W14101372-TP12
W14101372-TP20
W14101372-BH02
W14101545.001-TP02
W14101545.001-TP03
W14101171-BH14
W14101171-BH15
W14101171-BH11
W14101372-TP15
W14103526-TP03
TP01
TP02
TP03
TP04
TP05
TP06
TP07
TP08
TP09
TP10
TP11
TP12
TP13
TP14
TP15
PHASE 3C LIMITS
545 (GREENBELT)
546 (GREENBELT)
547 (GREENBELT)
544 (GREENBELT)
200 (GREENBELT)
207 (GREENBELT)
341 (PUL)
355 (PUL)
535 (PUL)
346 (PUL)
534
533
542 (PARK)
538 (INSTITUTIONAL)
539 (PARKING)
540 (PARKING)
541 (PARK)
434
432
431
433
430
435
436
437
438
420
160
167
CASCA BOULEVARD
KENO WAY
GREENBELT
LOT 413 (GREENBELT)

LEGEND
- BOREHOLE LOCATION
- MONITORING WELL LOCATION
- HISTORICAL TESTPIT LOCATION
- TESTPIT LOCATION (DECEMBER 2016 TO MARCH 2017)

0 50m
Scale: 1:1,250 @ 22"x34"

CLIENT: Yukon Government

PHASE 3C GEOTECHNICAL EVALUATION
WHISTLE BEND - WHITEHORSE, YUKON

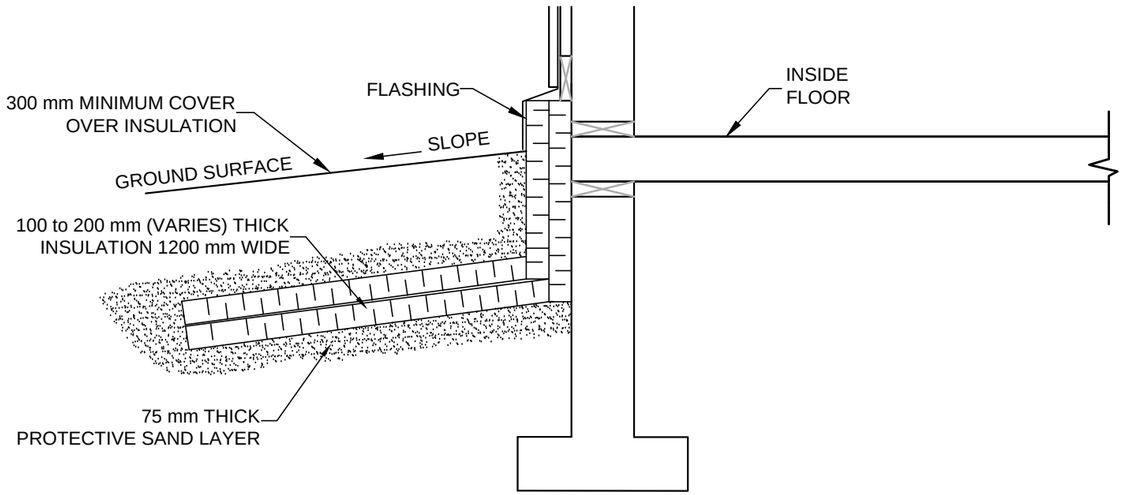
SITE PLAN SHOWING
BOREHOLE AND TESTPIT LOCATIONS

TETRA TECH

PROJECT NO.	DWN	CKD	REV
W14103567-18.004	CB	MCP	0
OFFICE: EBA-WHSE	DATE: March 17, 2017		

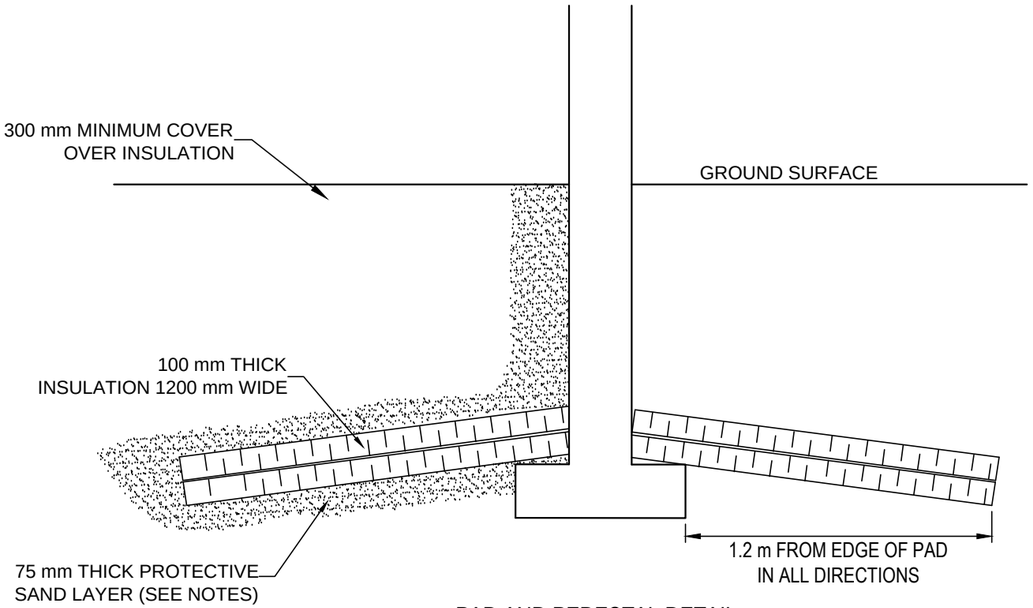
Figure 1 - 3C

C:\Whitehorse\Data\03Sitemap\WhitehorseWHS1\W14103567.18 Whistle Bend Existing Geo Compilation\W14103567.18.004 (Phase 3C Fig 1.4R.dwg [FIGURE 1 - 3C] March 17, 2017 - 2:59:39 pm (BY: BUCHAN, CAMPION)



SECTION - STRIP FOOTING

N.T.S.



PAD AND PEDESTAL DETAIL

N.T.S.

PLAN

N.T.S.

NOTES :

- THE INSULATION (DOW CHEMICAL HI SERIES STYROFOAM OR POLYURETHANE OR APPROVED EQUIVALENT) SHOULD BE MOISTURE RESISTANT AND SUITABLE FOR BURIAL UNDER VEHICULAR TRAFFIC AREAS.
- A MINIMUM BEDDING THICKNESS OF 75 mm OF FINE TO MEDIUM GRAINED SAND SHOULD BE PLACED ABOVE AND BELOW THE INSULATION FOR PROTECTION.
- THIS PLAN IS NOT TO SCALE

CLIENT

Yukon Government

TETRA TECH

PHASE 3 GEOTECHNICAL EVALUATION
WHISTLE BEND - WHITEHORSE, YUKON

FOUNDATION INSULATION DETAILS

PROJECT NO.	DWN	CKD	REV
W14103567-18.004	CB	MCP	0

OFFICE	DATE
EBA-WHSE	January 25, 2016

Figure 2

APPENDIX A
PHASE 3C TESTHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated - composed of thin layers of varying colour and texture.
Interbedded - composed of alternate layers of different soil types.
Calcareous - containing appreciable quantities of calcium carbonate.;
Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE - GRAINED SOILS More than 50% retained on No. 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly-graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS	Liquid limit <50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity
		Liquid limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
	CLAYS Above "A" line on plasticity chart negligible organic content	Liquid limit <30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays
		Liquid limit 30-50	CI	Inorganic clay of medium plasticity, silty clays
		Liquid limit >50	CH	Inorganic clay of high plasticity, fat clays
	ORGANIC SILTS AND CLAYS	Liquid limit <50	OL	Organic silts and organic silty clays of low plasticity
		Liquid limit >50	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, muck and other highly organic soils

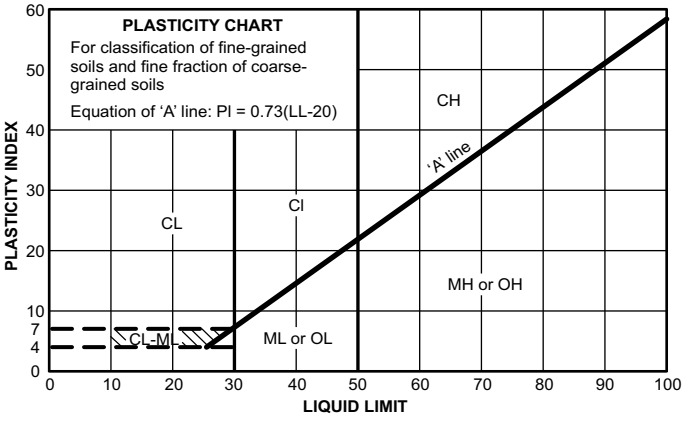
LABORATORY CLASSIFICATION CRITERIA

Classification on basis of percentage of fines
GW, GP, SW, SP
GM, GC, SM, SC
Borderline classification requiring use of dual symbols

$C_U = D_{60} / D_{10}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
Not meeting both criteria for GW	
Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
Atterberg limits plot above 'A' line and plasticity index greater than 7	

Less than 5% pass 75 µm sieve
More than 12% pass 75 µm sieve
5% to 12% pass 75 µm sieve

$C_U = D_{60} / D_{10}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
Not meeting both criteria for SW	
Atterberg limits plot above 'A' line and plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
Atterberg limits plot above 'A' line and plasticity index greater than 7	



* Based on the material passing the 75 mm sieve

† ASTM Designation D 2487, for identification procedure see D 2488 USC as modified by PFRA

GROUND ICE DESCRIPTION

ICE NOT VISIBLE

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
N	Nf	Poorly-bonded or friable	
	Nbn	No excess ice, well-bonded	
	Nbe	Excess ice, well-bonded	

VISIBLE ICE LESS THAN 50% BY VOLUME

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
V	Vx	Individual ice crystals or inclusions	
	Vc	Ice coatings on particles	
	Vr	Random or irregularly oriented ice formations	
	Vs	Stratified or distinctly oriented ice formations	

VISIBLE ICE GREATER THAN 50% BY VOLUME

ICE	ICE + Soil Type	Ice with soil inclusions	
	ICE	Ice without soil inclusions (greater than 25 mm thick	

NOTES:

1. Dual symbols are used to indicate borderline or mixed ice classifications.
2. Visual estimates of ice contents indicated on borehole logs ± 5%
3. This system of ground ice description has been modified from NRC Technical Memo 79, Guide to the Field Description of Permafrost for Engineering Purposes.

LEGEND: Soil ☐ Ice ■

Government of Yukon - Community Services

Testpit No: **TP04**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3	Ground Elev: 676.5 m
Whitehorse, Yukon	UTM: 494362 E; 6738086 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0	Excavated	ORGANICS - black, (150 mm thick)	Seasonally frozen			676
		SILT (GLACIOLACUSTRINE) - trace to some clay, olive brown				
1		- moist	Unfrozen			675
		END OF TESTPIT (1.5 metres)				
2						674
3						

TETRA TECH

Contractor: Arctic Backhoe Services	Completion Depth: 1.5 m
Drilling Rig Type: CAT Rubber Tired Backhoe	Start Date: 2016 December 05
Logged By: MCP	Completion Date: 2016 December 05
Reviewed By: CPC	Page 1 of 1

Government of Yukon - Community Services

Testpit No: **TP09**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3	Ground Elev: 677 m
Whitehorse, Yukon	UTM: 494255 E; 6738305 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0	Excavated	ORGANICS - thin veneer left after stripping, black, (50 mm thick)	Seasonally frozen			677
		SILT (GLACIOLACUSTRINE) - trace to some clay, olive brown				
		- moist	Unfrozen			
1						676
		END OF TESTPIT (1.5 metres)				
2						675
3						674

TETRA TECH

Contractor: Arctic Backhoe Services	Completion Depth: 1.5 m
Drilling Rig Type: CAT Rubber Tired Backhoe	Start Date: 2016 December 05
Logged By: MCP	Completion Date: 2016 December 05
Reviewed By: CPC	Page 1 of 1

Government of Yukon - Community Services

Testpit No: **TP10**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3	Ground Elev: 677.5 m
Whitehorse, Yukon	UTM: 494105 E; 6738422 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0	Excavated	ORGANICS - thin veneer left after stripping, black, (50 mm thick)	Seasonally frozen			677
		SILT - sandy, uniformly graded, brown, fine sand				
		SAND - some silt, becoming trace silt with depth, damp, brown, fine to medium sand	Unfrozen			
1						676
2						675
3						

TETRA TECH

Contractor: Arctic Backhoe Services	Completion Depth: 3 m
Drilling Rig Type: CAT Rubber Tired Backhoe	Start Date: 2016 December 05
Logged By: MCP	Completion Date: 2016 December 05
Reviewed By: CPC	Page 1 of 2

Government of Yukon - Community Services

Testpit No: **TP11**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3	Ground Elev: 679 m
Whitehorse, Yukon	UTM: 474273 E; 6738470 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0						679
	Excavated	SAND - silty, uniformly graded, brown, fine sand	Seasonally frozen			
		- trace to some silt, damp	Unfrozen			
1						678
2						677
		END OF TESTPIT (2.5 metres)				
3						676

TETRA TECH

Contractor: Arctic Backhoe Services	Completion Depth: 2.5 m
Drilling Rig Type: CAT Rubber Tired Backhoe	Start Date: 2016 December 05
Logged By: MCP	Completion Date: 2016 December 05
Reviewed By: CPC	Page 1 of 1

Government of Yukon - Community Services

Testpit No: **TP12**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3	Ground Elev: 678.5 m
Whitehorse, Yukon	UTM: 494366 E; 6738379 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0		ORGANICS - thin veneer left after stripping, black, (50 mm thick)	Seasonally frozen			678
		SAND - some silt to silty, brown, fine sand				
		- damp	Unfrozen			
1	Excavated	- cleaner, fine to medium sand				677
2						
		END OF TESTPIT (2.5 metres)				676
3						

TETRA TECH

Contractor: Arctic Backhoe Services	Completion Depth: 2.5 m
Drilling Rig Type: CAT Rubber Tired Backhoe	Start Date: 2016 December 05
Logged By: MCP	Completion Date: 2016 December 05
Reviewed By: CPC	Page 1 of 1

Government of Yukon - Community Services

Testpit No: **TP13**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3C	Ground Elev: 680 m
Whitehorse, Yukon	UTM: 494310 E; 6738435 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0		SAND - some silt to silty, uniformly graded, light brown, fine sand	Seasonally frozen			680
1		- trace of silt				679
2	Excavator	- sloughing badly below 2.00 metres	Unfrozen			678
3						677
4						676
		SILT (GLACIOLACUSTRINE) - trace to some clay, moist, olive brown				
5		END OF TESTPIT (5.00 metres)				675
6						674
7						673
7.5						

TETRA TECH

Contractor: Castle Rock Ent.	Completion Depth: 5 m
Drilling Rig Type: Linkbelt 330 Tracked	Start Date: 2017 March 15
Logged By: MCP	Completion Date: 2017 March 15
Reviewed By: CPC	Page 1 of 1

Government of Yukon - Community Services

Testpit No: **TP14**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3C	Ground Elev: 677.5 m
Whitehorse, Yukon	UTM: 494420 E; 6738450 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Elevation (m)
0	Excavator	SAND - some silt to silty, uniformly graded, light brown, fine sand	Seasonally frozen			677
1		SILT (GLACIOLACUSTRINE) - trace to some clay, olive brown				
		END OF TESTPIT (1.20 metres)				676
2						675
3						674
4						673
5						672
6						671
7						670
7.5						

TETRA TECH

Contractor: Castle Rock Ent.	Completion Depth: 1.2 m
Drilling Rig Type: Linkbelt 330 Tracked	Start Date: 2017 March 15
Logged By: MCP	Completion Date: 2017 March 15
Reviewed By: CPC	Page 1 of 1

Government of Yukon - Community Services

Testpit No: **TP15**

Project: Geotechnical Evaluation Services	Project No: W14103567-18.004
Location: Whistle Bend Subdivision - Phase 3C	
Whitehorse, Yukon	UTM: 494180 E; 6738510 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		SAND - some silt to silty, uniformly graded, light brown, fine sand	Seasonally frozen			0
		- cleaner, medium brown, medium sand				1
1						2
						3
						4
						5
						6
2	Excavator	- sloughing badly below 2.00 metres	Unfrozen			7
						8
						9
3						10
						11
		SILT (GLACIOLACUSTRINE) - trace to some clay, moist, olive brown				12
						13
4		END OF TESTPIT (4.00 metres)				14
						15
						16
5						17
						18
						19
6						20
						21
						22
7						23
7.5						24

TETRA TECH

Contractor: Castle Rock Ent.	Completion Depth: 4 m
Drilling Rig Type: Linkbelt 330 Tracked	Start Date: 2017 March 15
Logged By: MCP	Completion Date: 2017 March 15
Reviewed By: CPC	Page 1 of 1

Geotechnical Evaluation	AECOM	BOREHOLE NO: BH13
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT: W14101171
Whitehorse, YT		

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC ROOT MATERIAL - seasonally frozen, brown and black						0
	SAND - silty, trace organics at upper interface, fine grained, uniform, damp below seasonal frost, medium brown		1		●		
	- sand becomes slightly coarser, trace silt, dry to damp, medium greyish brown						
1			2		●	● ▲	5
	- trace to some gravel from 1.5 to 2.5 m						
2							
	SILT - some clay, trace fine sand, damp, firm, light olive		3		●		
3	- moisture content increases with depth, firm, becomes dark olive						10
4			4		●		15
5	- easy drilling throughout depth of borehole						
			5		●		
6	END OF BOREHOLE @ 6.0 m						20
7							25
8							
9							30
10							33

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 08/12/10
DRAWING NO:	Page 1 of 1

Whistle Bend Subdivision	CLIENT: Associated Engineering	BOREHOLE NO: BH01
Detailed Geotechnical Design	DRILL: Nodwell Mounted CME 75	PROJECT: W14101372.002
Pumphouse, Whitehorse, YT		

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	GROUND ICE DESCRIPTION AND COMMENTS	Depth (ft)
0	TEA GROUND COVER and ORGANIC ROOT MAT - damp, medium brown		SA01			0
	SAND - silty, fine grained, uniform, damp, loose, medium brown					
1	SILT - some fine sand, trace clay, damp, stiff, light olive					5
	- smooth drilling		SA02	19		
2						
3	- thin lens of moist soil @ 3.0 m		SA03	18		10
4						
5			SA04	15		15
	- moisture content increases below 5.5 m, firm, darker olive in colour					
6			SA05	10		20
	END OF BOREHOLE @ 6.5 m					
7						25
8						
9						30
10						
11						35
12						39

BULK DENSITY (kg/m³) 1400 1600 1800 2000 | SPT (N) 20 40 60 80 | PLASTIC M.C. LIQUID 20 40 60 80 | CLAY (%) 20 40 60 80 | SILT (%) 20 40 60 80 | SAND (%) 20 40 60 80 | GRAVEL (%) 20 40 60 80

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 6.5m
REVIEWED BY: CPC	COMPLETE: 10/07/19
DRAWING NO:	Page 1 of 1

Whistle Bend Subdivision	CLIENT: Associated Engineering	BOREHOLE NO: BH02
Detailed Geotechnical Design	DRILL: Nodwell Mounted CME 75	PROJECT: W14101372.002
Sanitary Lift Station, Whitehorse, YT		

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	TEA GROUND COVER and ORGANICS - damp, black							0
	SILT - trace clay, trace fine sand, damp, firm to dense, light to medium olive by 2.7 m with slight increase in moisture content		SA06					
1								5
2			SA07	13				
3			SA08	14				10
4	- very moist by 4.5 m, becoming wet with depth							
5			SA09	9				15
6	- last 150 mm of 6.0-6.5 m SPT is wet, soft and dark grey		SA10	7				20
7								
8	- very soft, increased clay content and plasticity		SA11	3				25
9			SA12	4				30
10								
11	- colder with depth, maybe close to 0°C @ 10.5 m		SA13	3				35
	END OF BOREHOLE @ 11.0 m							
12								39

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 11m
REVIEWED BY: CPC	COMPLETE: 10/07/19
DRAWING NO:	Page 1 of 1

Whistle Bend Subdivision	CLIENT: Associated Engineering	TESTPIT NO: TP16
Detailed Geotechnical Design	EXCAVATOR: Komatsu Rubber Tired Backhoe	PROJECT: W14101372.002
Casca & Phases I and II, Whitehorse, YT		

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC ROOT MAT - seasonally frozen, black					0
	SAND - some silt to silty to 0.8 m, cleaner with trace of silt from 0.8 m to 1.2 m, seasonally frozen to 0.3 m, medium brown					
1						
	SILT (GLACIOLACUSTRINE) - trace clay, trace fine sand, damp to moist, medium olive					5
2	END OF TESTPIT @ 2.0 m NOTE: Testpit excavated at intersection of Casca Blvd (north leg) at the sanitary force main crossing					
3						10

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 2m
REVIEWED BY: CPC	COMPLETE: 10/10/18
DRAWING NO:	Page 1 of 1

Whistle Bend Subdivision	CLIENT: Associated Engineering	TESTPIT NO: TP17
Detailed Geotechnical Design	EXCAVATOR: Komatsu Rubber Tired Backhoe	PROJECT: W14101372.002
Casca & Phases I and II, Whitehorse, YT		

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC ROOT MAT - seasonally frozen, black					0
	SAND - silty to some silt to 0.5 m, becomes cleaner with trace silt below 0.5 m, damp, medium to dark brown at 0.5 m					
1						
						5
	SILT (GLACIOLACUSTRINE) - trace clay, trace fine sand, damp to moist, medium olive					
2	END OF TESTPIT @ 2.0 m NOTE: Testpit excavated near north end of Casca Blvd					
3						10

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 2m
REVIEWED BY: CPC	COMPLETE: 10/10/18
DRAWING NO:	Page 1 of 1

APPENDIX B
TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT – YUKON GOVERNMENT

This report incorporates and is subject to these “General Conditions”.

1.1 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of TETRA TECH’s Client, the Yukon Government. TETRA TECH does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than TETRA TECH’s Client unless otherwise authorized in writing by TETRA TECH. Any unauthorized use of the report is at the sole risk of the user.

1.2 ALTERNATE REPORT FORMAT

Where TETRA TECH submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed TETRA TECH’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by TETRA TECH shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of TETRA TECH’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except TETRA TECH. TETRA TECH’s instruments of professional service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.4 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.5 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.6 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.7 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.8 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.9 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

1.10 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.11 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.12 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

1.13 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.14 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of the report, TETRA TECH may rely on information provided by persons other than the Client. While TETRA TECH endeavours to verify the accuracy of such information when instructed to do so by the Client, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

TETRA TECH

May 11, 2018

ISSUED FOR USE
FILE: ENG.WARC03380-01
Via Email: bartschs@ae.ca

Associated Engineering (B.C.) Ltd.
301 – 4109 4th Avenue
Whitehorse, YT Y1A 1H6

Attention: Mr. Steven Bartsch. P.Eng. – Area Manager, Yukon & NWT

Subject: Geotechnical Evaluation – Phase 5
Whistle Bend Subdivision – Whitehorse, Yukon

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by Associated Engineering (B.C.) Ltd. (AE) to collect additional geotechnical information for Phase 5 of the Whistle Bend Subdivision.

This report summarizes the work completed and the conditions encountered, along with presenting recommendations to support final design.

2.0 GEOTECHNICAL INFORMATION FROM PREVIOUS EVALUATIONS

Prior to the current evaluation work, other geotechnical evaluations had been completed throughout the Phase 5 area of the Whistle Bend Subdivision, including:

- Project No W14101171 - 2008: Two boreholes were drilled to 6 m on and north of the old CBC tower site as part of the AECOM Predesign Geotechnical Evaluation;
- Project No W14101372.002 – 2010: A testpit was excavated at the intersection of Casca Boulevard and Leota Street along the south side of Phase 5;
- Project No W14101545.001 - 2011: A testpit was excavated close to what is now Witch Hazel Drive as part of the Morrison Hershfield Soil Infiltration study; and,
- Project No W23101141: - 2008: a deep borehole (60 m) was drilled along Leota Drive on the south side of Phase 5 for a Geothermal Assessment project completed for the City of Whitehorse.

The historic and recent testhole logs used for this geotechnical evaluation are presented in Appendix A of this report.

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Whitehorse, YT Y1A 0H7 CANADA
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3.0 CURRENT SITE ASSESSMENT

On April 22, 2018, ten boreholes were drilled throughout the east half of Phase 5. Due to soft, wet conditions, access throughout the west half of the study area was limited so evaluation has been based on historic data collected during the completion of the projects listed in Section 2.0 and conditions noted along the sidewalls of the storm drainage swale excavated along the west side of the site.

All boreholes were drilled to a termination depth of 6.0 m with a truck mounted CME 75 drill rig contracted from Don Jeck Services of Whitehorse, Yukon. The drill rig was equipped with solid flight augers. Tetra Tech's site representative was Mr. Myles Plaunt, CET of Tetra Tech's Whitehorse office.

Disturbed grab samples were collected at regular intervals throughout the depth of each of the boreholes drilled. Samples were returned to the Whitehorse laboratory for visual classification purposes only.

Upon completion, all boreholes were backfilled to grade to ensure safe site conditions and UTM coordinate locations of the boreholes were recorded using a hand-held GPS unit.

The location of the current and previously completed testholes used for this evaluation are all presented on Figure 1, attached and as mentioned above, the detailed testhole logs are presented in Appendix A.

4.0 SITE DESCRIPTION & GEOTECHNICAL CONDITIONS

4.1 Surface Conditions & Terrain

At the time of the current field investigation, the area was cleared but not stripped or grubbed.

In general, the far northeast corner and the two edges bordering the Ta'an selection sit at a higher elevation than the remainder of the site. It is understood that the preliminary grading plans suggest that there will be significant volumes of fill placed during development.

4.2 Subsurface Conditions

4.2.1 Soil Conditions

As was expected, the area is underlain by glaciolacustrine silt. And very little good quality sand was noted overlying the silts. During the drilling program, attention was given to areas that defined micro terrain units since they tend to suggest the presence of glaciofluvial or eolian sand. Boreholes BH05, BH08, BH10 and BH11 were all drilled where significant thicknesses of surficial sand could be recovered for use as pipe bedding or structural fill.

Along with the four boreholes mentioned, significant thicknesses of sand was noted at the far north end of the drainage swale.

4.2.2 Groundwater

No groundwater has been noted in any of the current or historical testholes advanced throughout the study area.

4.2.3 Seasonal Frost and Permafrost

On April 22, 2018 , the top 0.2 to 0.4 m was thawed but below this depth seasonal frost was still noted to depths of 2.0 m or better.

Permafrost was not encountered (or anticipated) at this location.

4.2.4 Bedrock

Bedrock has not been encountered in any of the deep boreholes drilled throughout the Whistle Bend Subdivision area.

5.0 RECOMMENDATIONS

5.1 Challenges Related To Deep Utility Construction

As expected the biggest challenge related to deep utility construction will be material reuse. Although the moisture content of the majority of the glaciolacustrine silt samples collected during the April 22, 2018 field investigation were acceptable, there were depths where moistures in excess of 30% were noted (refer to the current borehole logs where transitions between moist, which would be acceptable as backfill, and wet, which will possibly prove problematic if not dried out in advance of reuse). If the moisture content of the soils in the spoil piles is more than +3% above optimum moisture, the contractor should be prepared to disturb the spoil piles in an attempt to reduce the moisture content and make it suitable for use as backfill below 1.7 m in the deep utility trenches.

Soft, wet soil conditions at invert elevations may necessitate the use of bedding stone under and around pipes.

5.2 Underground Utilities Construction

The excavation of deep utility trenches must conform to Yukon *Occupational Health and Safety Regulations* guidelines. The fine-grained soils at depth throughout Phase 5 should not be prone to sloughing, therefore, trench side slopes cut to 0.75:1.0 (horizontal:vertical) should ensure safe, compliant, working conditions. If areas of instability are encountered, the contractor should relax the trench sideslopes as required.

All material excavated from the utility line trenches can be considered for backfill at depth. However, as mentioned above, material reuse will be dependent upon moisture content.

Deep utility line backfill should be placed in 200 mm thick lifts and compacted to 95% of Standard Proctor Maximum Dry Density (SPMDD) for material placed below 1.0 m from grade and 98% of SPMDD for backfill placed in the final 1.0 m from grade.

It is recommended that a Class "B" pipe bedding configuration (commonly used on YG and City of Whitehorse projects with 150 mm of bedding under the pipe, beside the pipe and 300 mm above the pipe) be specified for this project. When compacted to at least 95% of SPMDD, this bedding configuration will ensure proper support and protection of the utility lines during backfill.

Bedding may be imported bedding sand in dry areas, or bedding stone in areas where wet and unstable conditions are encountered below invert elevations.

Imported bedding sand and stone should conform to the gradation specifications presented in Table 1.

Table 1: Recommended Pipe Bedding Materials Specifications

BEDDING SAND		25 mm BEDDING STONE	
Particle Size (mm)	**% Passing by Mass**	**Particle Size (mm)**	**% Passing by Mass**
10.000	100	25.000	100
5.000	80 – 100	20.000	70 - 100
2.000	55 – 100	12.500	55 – 100
0.630	25 – 65	10.00	30 – 80
0.250	10 – 40	5.000	0 – 40
0.080	2 – 15	2.000	0 – 10

Note: Gradation Limits From City of Whitehorse Servicing Standards Manual

5.3 Seasonal Frost Penetration

Based on the installation depths of the utility line piping, there will likely be some installation within the estimated depth of seasonal frost penetration. However, it is assumed that the civil consultant (Associated Engineering) has addressed this concern and the final design has appropriate mitigative measures.

5.4 Soil Corrosivity

5.4.1 Factors Contributing To Soil Corrosivity

Soil corrosivity and pipe corrosion are not considered to be directly measurable; however, research suggests that the main factors contributing to soil corrosivity include:

- Aeration – since well aerated soils generally have lower water retention properties (grain size) and better evaporation rates, loamy and sandy soils are desirable around ductile iron pipes and fittings. However, typical construction methods (the compaction process), will affect the aeration potential;
- pH – The acidity of a soil can lead to extreme corrosion rates and pitting. When pH levels are below 4.5 (very acidic) or above 9.1 (strongly alkaline), high corrosion loss rates can be expected;
- Moisture Content and Resistivity – Since water is one of the components necessary for electrochemical corrosion (along with oxygen and metal), the moisture content of the soil is probably the most important factor in assessing potential. Increased moisture contents will result in lower resistivity in soil and therefore increasing potential for corrosion. Interesting to note, however, research suggests that once the soil is saturated, the additional moisture has no increased effect on resistivity; and
- Temperature – Soils at or below freezing will have increased resistivity for a given moisture content and if this happens rapidly (which would be the case in the Yukon), the increase in resistivity corresponds to decreases in the corrosive potential of the soil.

5.4.2 Soil Corrosivity Testing

To assess potential for corrosivity, an analytical lab can perform a suite of tests that includes:

- Physical tests including Conductivity, percent of Moisture, pH, Redox Potential, and Resistivity;
- Leachable Anions and Nutrient testing including Chloride and Sulphide testing; and

- Anion and Nutrient testing including Sulphate testing.

5.4.3 Interpretation Of Corrosivity Results

Although soil corrosivity is not a directly measurable soil parameter, there are systems and methods that attempt to predict potential and the resulting corrosion of metallic pipe and fittings based on soil properties. Two of the more widely used methods are the American Waste Water Association (AWWA) 10 point scoring method that bases potential on the weighted aggregation of 5 soil properties. A second method that is used is the Spicklemire (2002) 25 point scoring method which is similar to the AWWA method but has additional factors. For the purpose of this exercise, the AWWA method will be used to assess potential. The five soil parameters used to calculate the weighted aggregation includes resistivity, pH, redox potential, sulphides and moisture content. If the total is greater than 10 points, protective measures such as cathodic protection of cast iron alloys is warranted.

As part of the Whistle Bend Phase 3D and 3E a composite sample of soil from various depths was submitted for testing. As mentioned in an April 26, 2018 email, the results were assessed using the AWWA 10-point scoring method and the total was between 2 and 3. Since this is well below the threshold of 10, no concerns are anticipated.

5.5 Pavement Structure

As with previous phases throughout the It is assumed that pavement structure design for Phase 5 will include 75 mm of asphalt; 150 mm of 20 mm crushed basecourse; 200 mm of 50 mm crushed sub-base; 500 mm of pit run sub-base and 800 mm of select sand for residential streets and for collectors, 100 mm of asphalt, along with the same thicknesses of the granular components will be used for design.

5.5.1 Roadway Construction Recommendations

All imported granular materials (crushed basecourse, crushed sub-base and pit run sub-base) must meet the gradation limits presented in Table 2. If non-compliant materials are proposed, a sample can be submitted to Tetra Tech for testing and an opinion regarding suitability for use can be supplied.

Table 2: Imported Gravel Gradation Specifications

20 mm CRUSHED BASECOURSE AGGREGATE		80 mm PIT RUN SUB-BASE AGGREGATE		50 mm CRUSHED SUB-BASE AGGREGATE	
Particle Size (mm)	**% Passing by Mass**	**Particle Size (mm)**	**% Passing by Mass**	**Particle Size (mm)**	**% Passing by Mass**
20.000	100	80.000	100	50.000	100
12.500	64 – 100	25.000	55 - 100	25.000	55 - 100
5.000	36 – 72	12.500	42 - 84	12.500	42 - 84
2.500		5.000	26 - 65	5.000	26 - 65
1.250	12 – 42	1.250	11 - 47	2.500	
0.315	4 – 22	0.315	3 - 30	1.250	11 - 47
0.080	3 - 6	0.080	0 - 8	0.315	3 - 30
				0.080	0 - 8

Note: Gradation Limits From City of Whitehorse Servicing Standards Manual

All sub-base materials must be placed in lifts not exceeding 200 mm in thickness and the contractor should be prepared to moisture condition each lift to facilitate compaction. The crushed 20 mm basecourse aggregate can be placed in a single lift and final tight-blading and recompaction should be performed immediately prior to paving.

If soft areas are encountered during roadway reconstruction, additional subcut may be required (down to a dry, stable surface). When the subcut areas are being backfilled, all materials placed within the final meter must be compacted to at least 98% of SPMDD. For material placed below 1.0 m from finished grade, 95% of SPMDD is considered acceptable. All granular material placed as subcut backfill will have to be moisture conditioned to facilitate compaction.

5.5.1 Granular Structure Under Sidewalks

The typical Tetra Tech granular structure recommendation for paved surfaces and exterior concrete has always been 1.7 m of non-frost susceptible material. This recommendation was not followed during the design and construction of Phases 1 and 2 and this practice was carried forward during the construction of Phases 3 and 4.

Current information from Associated Engineering suggests that there are sections of sidewalk throughout Phase 3A (where there is less surficial sand cover than throughout Phases 1 and 2) that are experiencing frost heave damage and possible damage from construction traffic.

Therefore, to minimize the risk of damage along sections of separate walkway routes, construction should be over 1.7 m of non-frost susceptible soil. Anything less becomes a risk management issue.

5.6 Concrete

All concrete should be cast onto a clean, level, compacted, granular surfaces. It is important that no loose and/or disturbed material be allowed to remain on the bearing surface. Bearing surfaces should consist of 20 mm crushed basecourse gravel which has been moisture conditioned and compacted to at least 98% SPMDD.

Tetra Tech recommends that all concrete be designed, mixed, placed, and tested in accordance with the most recent edition of the Canadian Standards Association (CSA) Standard CAN/CSA-A23.1 and A23.2. According to these standards, concrete should be designed to at least satisfy the minimum durability requirements as defined by the exposure class.

The exposure class of the concrete is dependent on the presence or lack of chlorides, sulphates, freezing and thawing conditions, and the soil saturation. Based on the aforementioned conditions, the governing exposure class for all exterior concrete curb & gutter and sidewalks is C-2 which corresponds to a minimum compressive strength of 32 MPa and has 5% to 8% entrained air.

If shoulder season (early spring or late fall) construction is considered, Tetra Tech should be contacted and given the opportunity to review the contractor's cold weather concrete placement procedures.

6.0 FOUNDATION RECOMMENDATIONS

A Building Advisory was issued by The City of Whitehorse, Planning and Development on October 25, 2010. This advisory relates to *Drainage Standards for Building Foundations*. The requirements for drain rock, perimeter drainage systems and sump construction presented in the advisory will have to be followed for all foundations. The prescriptive measures are based on CSA and NBC specifications as summarized in the following sections.

6.1 Preserved Wood Foundation Recommendations

If the use of preserved wood foundations (PWF) is desired, a granular drainage layer will be required beneath all footings and basement slabs, in accordance with CAN-CSA S406, because of the impervious glaciolacustrine underlying material. If areas of free draining material are encountered it may be possible to remove the requirement for a gravel drainage layer (a geotechnical engineer should be consulted).

The granular drainage layer should be constructed using a clean crushed stone or screened drain rock material of maximum particle size 40 mm and having less than 10% sand (passing the 5 mm sieve). This layer shall be at least 125 mm thick and shall extend beyond the footing plate a minimum of 300 mm. The granular drainage layer shall drain to a sump which, in turn, shall drain to a point of final disposal beyond the building's footprint.

In accordance with CAN-CSA S406, the use of perimeter drainage tile or pipe is not recommended with PWF.

All backfill material placed within 600 mm of the foundation walls shall be free of deleterious debris, frozen materials, and boulders larger than 150 mm in diameter.

Existing soils can be used as backfill in service trenches so long as no cobbles are placed within one lift of any pipe installation and all backfill materials are compacted to at least 95% of SPMDD.

6.2 Concrete Foundation Recommendations

If the use of concrete foundations is desired, the drainage tile and pipe, granular drainage layers, drainage disposal and surface drainage specifications as per NBC 2005, Section 9.14 "Drainage" must be followed.

Full depth concrete foundations with concrete footings are required to have perimeter drainage tile which terminates in a sump pit. A sump pit is to be installed to assist in the removal of water from the foundation area (should water accumulation in the sump pit warrant it).

6.3 Foundations On Free Draining Soils

The prescriptive measures described above may not apply if adequate thicknesses of free draining soil exists below foundation elements. If underlying soils meet the conditions of "free draining" soils (as verified by geotechnical engineering staff capable of soil classification), the drainage layer and sump can be omitted. Since there will be significant site grading throughout Phase 5, it is difficult to predict whether there will be areas with adequate thicknesses of free draining soil so site specific assessments will be required to determine actual conditions.

7.0 FROST PENETRATION AND FROST HEAVE POTENTIAL

The underlying glaciolacustrine silt is considered to be very frost-susceptible. If the following recommendations are adhered to, the insulation should provide sufficient protection to the foundation from frost heave.

7.1 Insulation Recommendations – Heated and Unheated Structures

Tetra Tech recommends insulating foundations to mitigate potential for seasonal frost-heave damage. General foundation insulation recommendations are presented on Figure 2. If different footing burial depths or insulation configurations are desired, Tetra Tech would be pleased to revise their insulation recommendations accordingly.

8.0 CONSTRUCTION TESTING AND MONITORING

All recommendations presented herein are site-specific and based on the assumption that there will be an adequate level of monitoring during construction. An adequate level of construction monitoring also provides opportunity to verify that the recommendations based on geotechnical data obtained from the testholes used for this evaluation is applicable to the entire site. Appropriate quality assurance and quality control (QA/QC) testing should be undertaken during construction to confirm that construction is completed in accordance with the recommendations provided in this report. For this project, appropriate QA/QC inspection and testing is considered to include:

- Laboratory testing on samples of proposed fill materials to confirm compliance to specified gradation requirements (by sieve analysis) and compaction (proctor moisture density testing) requirements;
- Compaction, concrete and asphalt testing during construction to ensure that project objectives are met; and,
- Geotechnical inspections of foundation excavations.

9.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Associated Engineering (B.C.) Ltd. and their agents. Tetra Tech Canada Inc. (operating as Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Associated Engineering (B.C.) Ltd., or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix B. We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

PROFESSIONAL ENGINEER
YUKON TERRITORY
CHADWYCK P. COWAN
May 11/18

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PERMIT TO PRACTICE
TETRA TECH CANADA INC.
SIGNATURE
Date May 11/18
PERMIT NUMBER PP003
Association of Professional Engineers of Yukon

FIGURES

ENGWARC03380-01 EXP15

ENGWARC03380-01 BH06

ENGWARC03380-01 BH05

12025-BH03

RELIANCE STREET

SCOUT STREET

TKC C-9B

W14101171-BH16

CHANCE LANE

SADIE LANE

ENGWARC03380-01 BH07

GREEN STREET EAST

ENGWARC03380-01 BH08

VEDDER AVENUE

EUGENE AVENUE

ELLWOOD STREET

GREEN STREET NORTH

LUELLA LANE

PHASE 5 LIMITS

ENGWARC03380-01 BH11

GYPSY QUEEN LANE

ENGWARC03380-01 EXP16

WITCH HAZEL DRIVE

ENGWARC03380-01 BH09

ENGWARC03380-01 BH10

ENGWARC03380-01 BH12

W14101545.001-TP01

W14101372-TP17

ENGWARC03380-01 BH14

TYRELL CRESCENT

ENGWARC03380-01 BH13

CASCA BOULEVARD

FULTON LANE

GREENLINK LANE

W14101171-BH17

GODDARD WAY

545 (GREENBELT)

W14103567-18.004 TP15

GREENSTREET WEST

BREADWINNER LANE

W14103567-18.004 TP11

ENGWARC03299-BH03

ENGWARC03299-BH02

W14103567-18.004 TP10

W14103567-18.004 TP13

PEEP STREET

ENGWARC03299-BH01

W14103567-18.003-TP E-01

W14101372-TP16

SYBIL CIRCLE

W23101141.003-BH1-08

W14103567-18.003-TP03

546 (GREENBELT)

199
(Greenbelt)

ENGWARC03380-01 BH01

W14103567-18.003-TP09

W14101372-TP04

LEOTA STREET

W14103567-18.004 TP08

LEOTA STREET

(209 Greenbelt)

(210 Greenbelt)

35
(Park)

W14103567-18.003-TP04

LANE (Typ.)

547 (GREENBELT)

201 (Greenbelt)

W14101372-TP03

NER AVENUE

LEGEND

- BOREHOLE LOCATION
- TESTPIT LOCATION

0 50m

Scale: 1:1,250 @ 22"x34"

CLIENT: Yukon Government

TETRA TECH

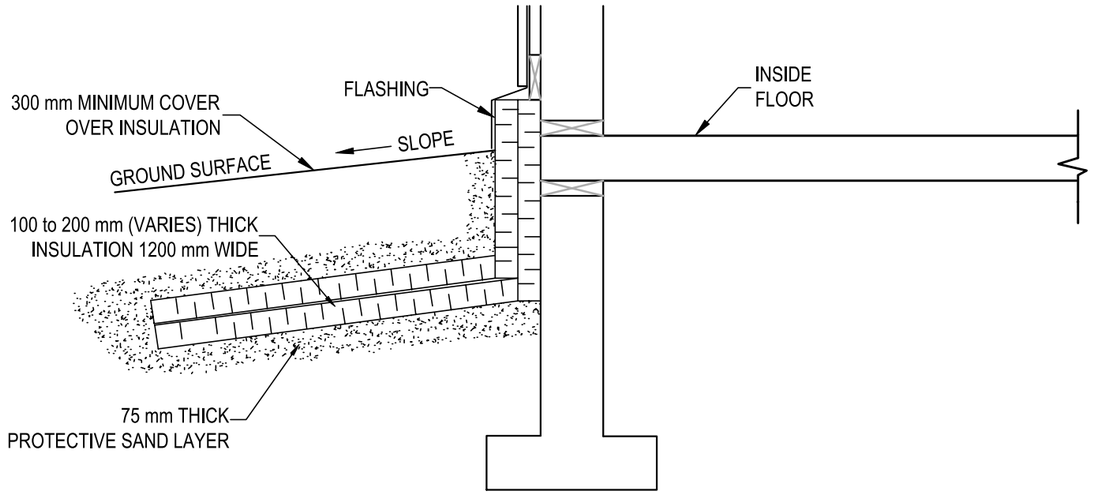
2018 GEOTECHNICAL SERVICES
WHISTLE BEND - WHITEHORSE, YUKON

SITE PLAN SHOWING
PHASE 5 TESTHOLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
ENG.WARC03380-01	CB	MCP	0
OFFICE: EBA-WHSE	DATE: May 7, 2018		

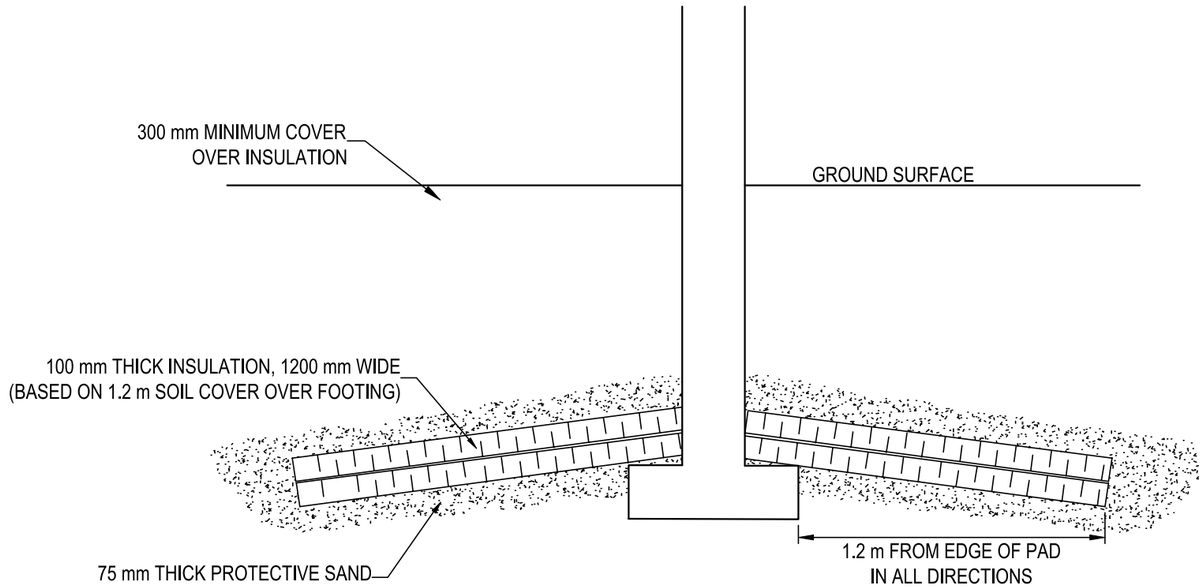
Figure 1

G:\Whitehorse\Data\2018\drawings\Whitehorse\ENG.WARC\ENGWARC03380-01 Whistle Bend 2018 Geotech Services\ENGWARC03380-01 Phase 5 Fig 1 RD.dwg [FIGURE 1] | May 07, 2018 - 9:01:48 am | BY: BUCHAN, CAMERON



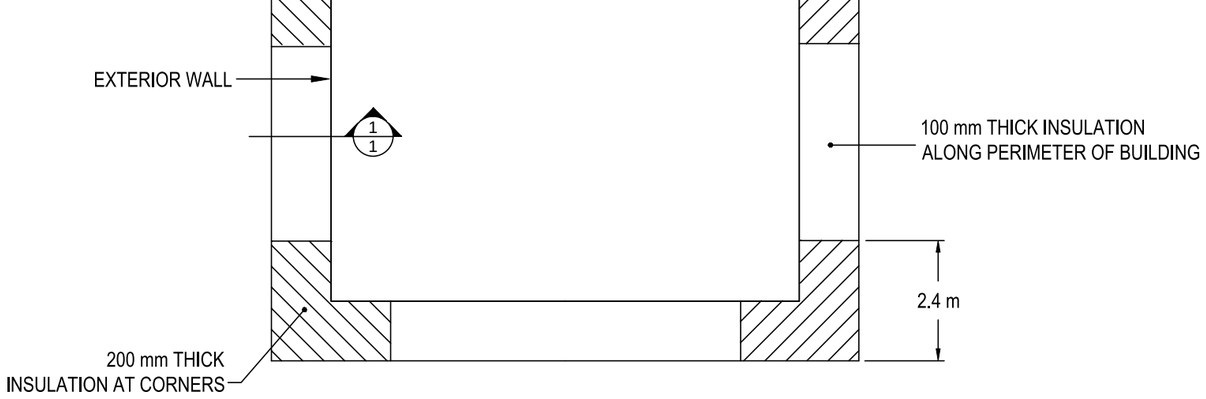
SECTION - STRIP FOOTING

N.T.S.



EXTERIOR PAD AND PEDESTAL DETAIL

N.T.S.



PLAN

N.T.S.

NOTES :

- THE INSULATION (DOW CHEMICAL HI SERIES STYROFOAM OR POLYURETHANE OR APPROVED EQUIVALENT) SHOULD BE MOISTURE RESISTANT AND SUITABLE FOR BURIAL UNDER VEHICULAR TRAFFIC AREAS.
- A MINIMUM BEDDING THICKNESS OF 75 mm OF FINE TO MEDIUM GRAINED SAND SHOULD BE PLACED ABOVE AND BELOW THE INSULATION FOR PROTECTION.
- THIS PLAN IS NOT TO SCALE

CLIENT

Yukon Government

TETRA TECH

2018 GEOTECHNICAL SERVICES
WHISTLE BEND - WHITEHORSE, YUKON

COMMERCIAL AND RESIDENTIAL FOUNDATION INSULATION DETAILS

PROJECT NO.	DWN	CKD	REV
ENG.WARC03380-01	CB	MCP	0

OFFICE	DATE
EBA-WHSE	May 7, 2018

Figure 2

APPENDIX A

TESTHOLE LOGS USED FOR THIS EVALUATION

Borehole No: **BH18-05**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493942 E; 6738888 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT - moist, black, (100 mm thick)	Unfrozen				0
		SAND - trace to some silt, brown, fine to medium sand					1
			Seasonally frozen				2
1							3
							4
							5
2		- damp	Unfrozen				6
							7
							8
							9
3	Solid stem auger	SILT (GLACIOLACUSTRINE) - some clay, damp, firm (est.), olive grey					10
							11
							12
4							13
							14
							15
5							16
							17
							18
6		END OF BOREHOLE (6.0 metres)					19
							20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-06**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493803 E; 6738905 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT - wet, black, (150 mm thick)	Unfrozen				0
		SILT (GLACIOLACUSTRINE) - some sand at upper interface, some clay, light olive grey, fine sand	Seasonally frozen				
1							1–5
		- damp to moist	Unfrozen				6
2							7–8
	Solid stem auger						9–10
3							10–11
							12
4							13–14
							15
5							16–17
							18
6		END OF BOREHOLE (6.0 metres)					19–20
							21
7							22–23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-07**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493812 E; 6738764 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT - wet, black, (100 mm thick)	Unfrozen				0
		SILT - some sand, brown, fine sand	Seasonally frozen				1
							2
		SAND - silty, brown, fine sand					3
1							4
		SILT (GLACIOLACUSTRINE) - some clay, mottled grey with brown at upper interface					5
		- olive grey					6
2							7
	Solid stem auger						8
		- moist	Unfrozen				9
3							10
							11
							12
4							13
		- 200 mm thick sand lens - silty, damp, fine sand					14
							15
							16
5							17
							18
							19
6		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-08**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493978 E; 6738733 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT AND SURFICIAL SILT - moist, black and brown, (200 mm thick)	Unfrozen				0
		SAND - trace silt, brownish grey, fine to medium sand	Seasonally frozen				1
1							2
							3
							4
		- damp	Unfrozen				5
2							6
							7
							8
	Solid stem auger						9
3							10
							11
							12
4							13
		SILT (GLACIOLACUSTRINE) - some clay, damp, olive grey					14
							15
		- moist					16
5							17
							18
							19
6		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-09**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493933 E; 6738618 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT - moist to wet, black, (200 mm thick)	Unfrozen				0
		SILT (GLACIOLACUSTRINE) - some clay, olive grey					1
			Seasonally frozen				2
1							3
							4
							5
2		- damp	Unfrozen				6
							7
							8
	Solid stem auger						9
3		- moist					10
							11
							12
4							13
							14
							15
5							16
							17
							18
6							19
		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-10**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 494103 E; 6738655 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT - moist, black, (100 mm thick)	Unfrozen				0
		SAND - trace to some silt, brown to brownish grey, fine to medium sand	Seasonally frozen				1
1							2
							3
							4
							5
2			Unfrozen				6
							7
							8
	Solid stem auger						9
3		SILT (GLACIOLACUSTRINE) - some clay, damp to moist, olive grey					10
							11
							12
							13
4							14
		- moisture content increasing					15
							16
5							17
							18
							19
6		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-11**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 494191 E; 6738675 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT AND SURFICIAL SILT - moist, black with brown, (150 mm thick)	Unfrozen				0
		SAND - trace to some silt, brown to brownish grey, fine sand	Seasonally frozen				
1							1
							2
							3
							4
							5
2							6
		- damp	Unfrozen				7
							8
		SILT (GLACIOLACUSTRINE) - some clay, damp to moist, olive grey					9
3	Solid stem auger						10
							11
							12
4							13
							14
							15
5		- moist to wet					16
							17
							18
							19
6		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-12**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 494263 E; 6738638 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT AND SURFICIAL SILT - moist to wet, black with brown, (150 mm thick)	Unfrozen				0
		SAND - trace to some silt, brown to brownish grey, fine to medium sand	Seasonally frozen				
1							1
							2
							3
							4
		SILT (GLACIOLACUSTRINE) - some clay, olive grey					5
		- moist to wet	Unfrozen				6
2							7
							8
							9
3	Solid stem auger						10
							11
							12
4							13
							14
							15
5							16
							17
							18
							19
6		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-13**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 494074 E; 6738555 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT AND SURFICIAL SILT - moist to wet, black with brown, (150 mm thick)	Unfrozen				0
		SAND - some silt to silty, brown	Seasonally frozen				1
							2
		SILT (GLACIOLACUSTRINE) - some clay, light to medium olive grey					3
1							4
		- moist	Unfrozen				5
							6
2							7
							8
	Solid stem auger						9
3		- moist to wet					10
							11
							12
4							13
							14
		- moist					15
							16
5		- wet					17
							18
							19
6		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **BH18-14**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493927 E; 6738562 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Sample Type	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT AND SURFICIAL SILT - moist to wet, black with brown, (300 mm thick)	Unfrozen				0
		SAND - silty, dark brown to brown	Seasonally frozen				1
		SILT (GLACIOLACUSTRINE) - some clay, light olive grey					2
1							3
							4
							5
		- damp	Unfrozen				6
2							7
							8
							9
3	Solid stem auger						10
							11
							12
4							13
							14
							15
5							16
							17
							18
							19
6		END OF BOREHOLE (6.0 metres)					20
							21
							22
7							23
7.5							24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 6 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **EXP18-15**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493710 E; 6738900 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0		ORGANIC ROOT MAT AND SURFICIAL SILT - wet, black with brown, (300 mm thick)	Unfrozen			0
	Solid stem auger	SAND - trace to some silt, damp, brownish grey, fine to medium sand	Face of exposure thawed			1–3
1						3–6
2						6–10
3						10–13
4						13–16
5		SILT (GLACIOLACUSTRINE) - some clay, moist to wet, olive grey				16–19
6		END OF EXPOSURE (5.8 metres) Note: Exposure logged is located along large drainage swale constructed on west edge of phase 5 at north end.				19–24
7						
7.5						

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 5.8 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Borehole No: **EXP18-16**

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Project: 2018 Geotechnical Services	Project No: ENG.WARC03380-01
Location: Phase 5 - Whistle Bend Subdivision	
Whitehorse, Yukon	UTM: 493650 E; 6738660 N; Z 8

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0	Solid stem auger	ORGANIC ROOT MAT AND SURFICIAL SILT - wet, black with brown, (150 mm thick)	Unfrozen			0
		SAND - some silt, damp, brown, fine to medium sand	Face of exposure thawed			
		SILT (GLACIOLACUSTRINE) - some clay, moist to wet, olive grey				
1						3
2						7
3						10
4						13
		END OF EXPOSURE (4.5 metres) Note: Exposure logged along large drainage swale immediately north of Witch Hazel Drive.				15
5						16
6						20
7						23
7.5						24

TETRA TECH

Contractor: DonJeck Services	Completion Depth: 4.5 m
Drilling Rig Type: Truck Mounted CME 75	Start Date: 2018 April 22
Logged By: MCP	Completion Date: 2018 April 22
Reviewed By: CC	Page 1 of 1

Geotechnical Evaluation	AECOM	BOREHOLE NO: BH16
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT: W14101171
Whitehorse, YT	100 m North of CBC Tower Clearing	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC ROOT MATERIAL - seasonally frozen, organic brown						0
	SAND - some silt to silty, damp below seasonal frost, dark brown		1				
1	- becomes clean and medium to fine grained, dry to damp, medium greyish brown						
	SILT - some clay, trace fine sand, damp, firm, light olive		2				5
2							
			3				
3	- moisture content increases with depth, still firm						10
4			4				
	- some mottling in soil at 4.5 m						15
5							
			5				
6	END OF BOREHOLE @ 6.0 m						20
7							25
8							
9							30
10							33

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 08/12/11
DRAWING NO:	Page 1 of 1

Geotechnical Evaluation	AECOM	BOREHOLE NO: BH17
Whistle Bend Subdivision	Drilling Method: NODWELL Mounted CME 75	PROJECT: W14101171
Whitehorse, YT	South End of CBC Tower	

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Depth (ft)
0	ORGANIC ROOT MATERIAL - seasonally frozen, black and brown				0
	SAND - some silt, trace organics, damp below seasonal frost, brown		1		
	- becomes SAND - trace silt, medium to fine grained, damp, greyish brown				
	SILT - some clay, trace fine sand, damp, firm, medium olive brown				
1			2		5
2	- moisture content increasing with depth, becoming softer				
			3		10
3					
4			4		15
	- sandy, silt lens from 4.1 to 4.3 m				
5			5		
6	END OF BOREHOLE @ 6.0 m				20
7					
8					25
9					30
10					33

BULK DENSITY (kg/m³) 1400 1600 1800 2000

SPT (N) 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

CLAY (%) 20 40 60 80

SILT (%) 20 40 60 80

SAND (%) 20 40 60 80

GRAVEL (%) 20 40 60 80

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 6m
REVIEWED BY:	COMPLETE: 08/12/11
DRAWING NO:	Page 1 of 1

Whistle Bend Subdivision	CLIENT: Associated Engineering	TESTPIT NO: TP16
Detailed Geotechnical Design	EXCAVATOR: Komatsu Rubber Tired Backhoe	PROJECT: W14101372.002
Casca & Phases I and II, Whitehorse, YT		

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	GROUND ICE DESCRIPTION AND COMMENTS	BULK DENSITY (kg/m³) 1400 1600 1800 2000 / SPT (N) 20 40 60 80 / PLASTIC M.C. LIQUID 20 40 60 80	CLAY (%) 20 40 60 80 / SILT (%) 20 40 60 80 / SAND (%) 20 40 60 80 / GRAVEL (%) 20 40 60 80	Depth (ft)
0	ORGANIC ROOT MAT - seasonally frozen, black					0
	SAND - some silt to silty to 0.8 m, cleaner with trace of silt from 0.8 m to 1.2 m, seasonally frozen to 0.3 m, medium brown					
1						
	SILT (GLACIOLACUSTRINE) - trace clay, trace fine sand, damp to moist, medium olive					
						5
2	END OF TESTPIT @ 2.0 m NOTE: Testpit excavated at intersection of Casca Blvd (north leg) at the sanitary force main crossing					
3						10

TETRA TECH EBA

LOGGED BY: MCP	COMPLETION DEPTH: 2m
REVIEWED BY: CPC	COMPLETE: 10/10/18
DRAWING NO:	Page 1 of 1

Whistle Bend Infiltration Testing	CLIENT: Morrison Hershfield Ltd.	TESTPIT NO: TP01
Whistle Bend Subdivision	EXCAVATOR: Komatsu 420 Rubber Tire Backhoe	PROJECT: W14101545.001
Whitehorse, YT		ELEVATION: 674 m

SAMPLE TYPE: DISTURBED | NO RECOVERY | SPT | A-CASING | SHELBY TUBE | CORE

BACKFILL TYPE: BENTONITE | PEA GRAVEL | SLOUGH | GROUT | DRILL CUTTINGS | SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	GROUND ICE DESCRIPTION AND COMMENTS	Elevation (m)
0	ORGANIC COVER			FROZEN TO 0.2 m	674.0
	SILT - some sand, trace clay, non plastic, olive brown, some organic inclusions				
	- becomes dry, firm			UNFROZEN	
	- organics end				
1					673.0
			SA01		
2	- becomes trace clay, trace sand				672.0
			SA02		
3	END OF TESTPIT @ 3.0 m (Machine Extent)				671.0
4					670.0

BULK DENSITY (kg/m³): 1400 1600 1800 2000

SPT (N): 20 40 60 80

PLASTIC M.C. LIQUID: 20 40 60 80

CLAY (%): 20 40 60 80

SILT (%): 20 40 60 80

SAND (%): 20 40 60 80

GRAVEL (%): 20 40 60 80

TETRA TECH EBA

LOGGED BY: JTP	COMPLETION DEPTH: 3m
REVIEWED BY: CPC	COMPLETE: 11/11/23
DRAWING NO: Figure 1	Page 1 of 1

GEOLOGIC LOG

BOREHOLE NO. BH1-08

PURPOSE OF HOLE:	Test Ground Heat Exchanger	LOCATION:	See Figure 1
DRILLING METHOD:	MUD Rotary	EASTING:	493688
START DRILLING:	August 25, 2008	NORTHING:	6738267
FINISH DRILLING:	August 27, 2008	ZONE:	8
CONTRACTOR:	Geotech Drilling Ltd.	GROUND ELEV (m - asl):	675 (approx)

Depth (m)	Lithology	Comments	U-Tube Construction Details
0m			ROAD-BOX
	SILTY SAND — 1.54m (5 ft)	Brown, some gravel	
	SILT/CLAY — 7.62m (25 ft)	Light grey, no inclusions	BENTONITE GROUT (+20% SOLIDS MIX RATIO)
10m			
20m			DRILLED 5 5/8" DIAMETER OPEN HOLE MUD ROTARY
30m			
40m			1" DIAMETER VANGUARD GEOPIPE ASTM D - 3 Ø 35 SDR 11 PE 3408
50m			
60m	SILT CLAY — 61.0m (200 ft)	Greenish grey, no inclusions	BOTTOM OF U-TUBE AT 61.0m (200 ft)
	END OF HOLE		
70m			
80m			

ISSUED FOR REVIEW

CLIENT

City of Whitehorse

District Heating and Waste Heat Collection Feasibility Study for the Whistle Bend Development, Whitehorse, Yukon

BH1-08 Borehole Log & U-Tube Construction Details

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
W23101141.003	LM	KSJ	-

OFFICE: EBA-KELOWNA

DATE: January 20, 2009

Figure 2

\\eba.local\corp\Kelowna\Drafting\W2311\W23101141.003\W23101141.003_FIG 2-5_R0.dwg [Figure 2] January 20, 2009 - 11:25am Imagetech

APPENDIX B

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL – YUKON GOVERNMENT

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (**Yukon Government**) as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

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The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

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1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

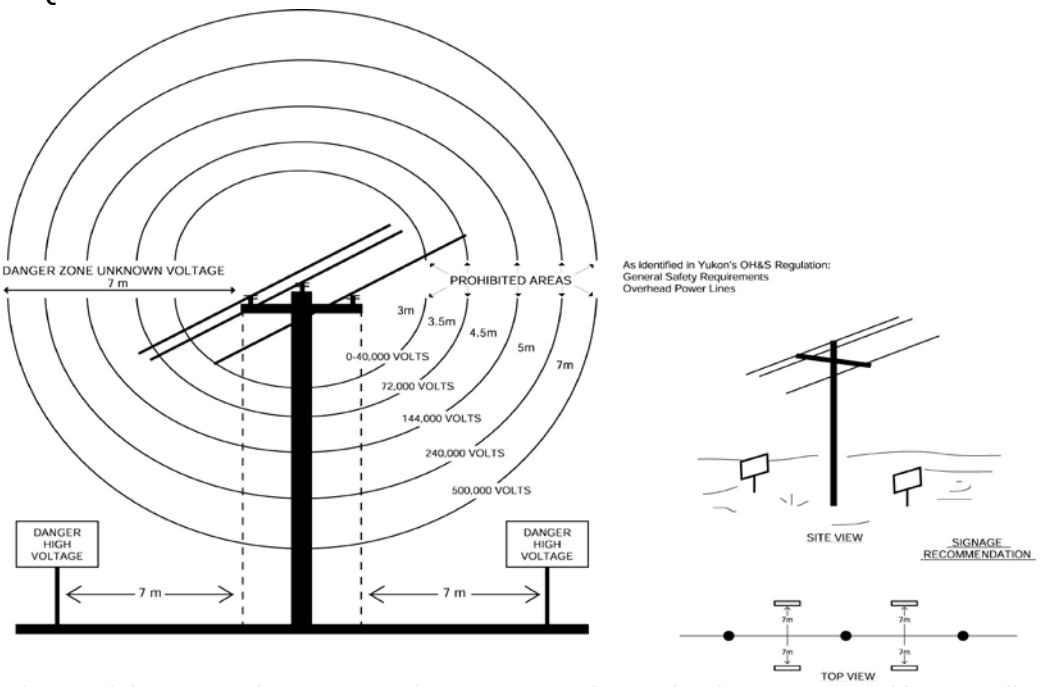
1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

MINIMUM REQUIREMENTS FOR UNQUALIFIED WORKERS AND/OR EQUIPMENT OPERATING NEAR OVERHEAD POWER LINES



Purpose: These minimum requirements are for your protection and safety. Contact with power lines is extremely dangerous and could result in death.

1) Danger Zone (unknown voltage) Equipment shall not work within 7metres (23 feet) of any overhead power line without notifying the local **ATCO ELECTRIC YUKON** office.

2) Prohibited Zone of identified voltages (confirmed by **ATCO ELECTRIC YUKON).**

a) No unqualified worker or equipment shall encroach on the Prohibited Zone.
b) Any work within the 7 meter (23 feet) Danger Zone, but outside the prohibited zone, requires an assigned designated person to act as an observer to ensure the safe limits of approach distances are maintained. The observer must be able to communicate by radio or air horn when workers or equipment violate these limits.

3) Power lines must be de-energized if workers or equipment cannot maintain Prohibited Zone clearances, unless under the **DIRECT** supervision of an ATCO ELECTRIC YUKON qualified employee.

4) Work around power lines is to be done during daylight hours only.

5) Workers are recommended to supply and install a minimum of two Danger High Voltage signs as shown above

6) Before work or other activity is commenced in the vicinity of an overhead power line, contact the local **ATCO ELECTRIC YUKON** office to establish the safe limits of approach distances.

7) No earth or other materials shall be placed under or adjacent to an overhead power line if it reduces the clearance above ground for the power line.

8) No person shall excavate or perform similar work in the vicinity of an overhead power line if it reduces the support for the power line.

Any violation could lead to sanctions under the Yukon OH&S Act and Regulation.

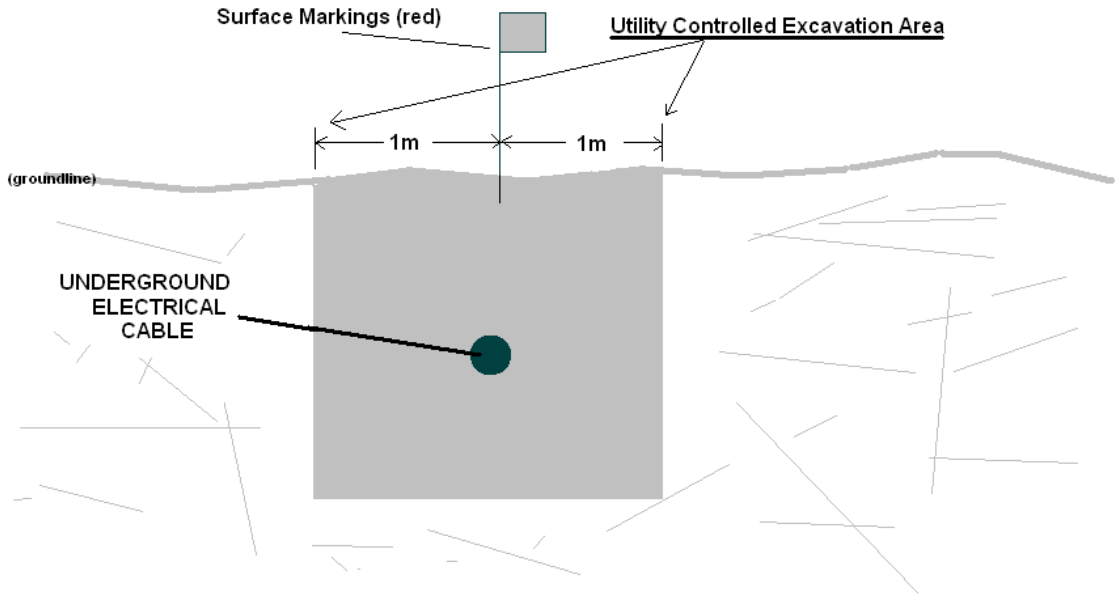
IF YOU ACCIDENTALLY CONTACT AN OVERHEAD POWER LINE

— STAY CLEAR AND CALL ATCO ELECTRIC YUKON —

633-7000 OR 1-800-661-0513

ATCO Electric
YUKON

MINIMUM REQUIREMENTS FOR UNQUALIFIED WORKERS AND/OR EQUIPMENT OPERATING NEAR UNDERGROUND CABLES



Purpose: These minimum requirements are for your protection and safety. Contact with underground power cables is extremely dangerous and could result in death.

1) Prior to any ground disturbance, the person responsible for the excavation must **contact ATCO ELECTRIC YUKON** to ascertain whether underground power cables are located at or near the excavation site.
   a) For ATCO ELECTRIC YUKON facilities, call **ATCO ELECTRIC YUKON** at **633-7000** or **1-800-661-0513** to request a "locate".
   b) For other underground facilities, contact the operator of the facility.
2) Prior to any ground disturbance or excavation activity, **ATCO ELECTRIC YUKON** will identify and mark any underground cables that are located near the utility controlled excavation area.
3) The person responsible for an excavation must make sure that no excavation work is undertaken within **1 m** of any underground power cables unless:
   a) The excavation work is done under the control of **ATCO ELECTRIC YUKON**, **and**
   b) The excavation work method is approved by **ATCO ELECTRIC YUKON**.

IF YOU ACCIDENTALLY DIG INTO AN UNDERGROUND POWER CABLE

— STAY CLEAR AND CALL ATCO ELECTRIC YUKON —

633-7000 OR 1-800-661-0513

ATCO Electric
YUKON

Water Main Testing and Commissioning Procedures

Introduction

All water main installation, connected to the City of Whitehorse water distribution system must be installed, disinfected and commissioned according to general accepted practices. The project consulting engineer and the contractor installing the pipe are responsible for ensuring pressure testing and disinfecting of new water mains in the City of Whitehorse water distribution system. Any pipe 75mm or larger will require disinfection and pressure testing. Bacteriological sampling is to be done by the consulting engineer or the City representative who will submit the samples to Yukon Environmental Health for analysis. A water main testing plan is to be submitted to the City of Whitehorse Engineering Department for approval a minimum of 5 days before testing is scheduled to begin. The testing plan must include, water main plan and profile (design or as-built) drawings, locations for flushing, test ports if required, proposed pressure test sections identified on a drawing, chlorination injection point, de-chlorination and disposal of super chlorinated water and sampling points.

Flushing

Water mains are to be flushed before the disinfecting of the mains begins. Water mains shall be flushed with a minimum flow velocity of 0.8 metres per second to ensure that all foreign materials and contaminants are removed from the main. Flushing must be witnessed and signed off by the consulting engineer or the designated City representative.

The table below summarizes the flow conditions required to achieve the specified 0.8 metres per second flow rate:

PIPE DIAMETER (mm)	REQUIRED FLOW FOR 0.8 M/S VELOCITY (L/S)	SIZE OF TAP (MM) NUMBER OF TAPS 25	40	50	NUMBER OF 2.5" HYDRANT NOZZLES*
100	6.5	1	-	-	1
150	13.0	-	1	-	1
200	26.0	-	2	1	1
250	38.0	-	3	2	1
300	57.0	-	-	2	2
450	100.0	-	-	4	2

Pressure and Leakage Testing

The purpose of the pressure and leakage test is to determine if the installation is capable of withstanding ordinary operating pressures without failure or excessive leakage at the joints and service connections. This is to be done after all service connections are complete and curb cocks (CC's) are installed. Contractors may perform an unofficial pressure test after the installation of the mains and before service connections are done to determine if there are any leaks in the main before continuing with service connections. The pressure pump must be capable of meeting required test pressure and include 2 accurate pressure gauges, backflow preventer and a pressure relief valve with an upper limit of 1400 KPa. The pump will be dedicated to water main pressure testing and will not be used for other construction activities. Water storage tanks will be of a non–corrosive material and be dedicated to water main testing. The volume of the tank shall not be more than 10 times the allowable leakage for the duration of the test.

General Procedures for Pressure and Leakage Test of D.I. and PVC Pipe

1. Install all water services, air relief valves and blow offs.
2. If boundary valves are required to be opened contact PW's. Under no circumstances is a contractor or consultant to operate a boundary valve.
3. Partially or completely backfill excavation before testing.
4. Wait a minimum 3 days for concrete thrust blocks to cure.
5. Ensure that main stops are open and curb stops are closed.
6. Inform City of Whitehorse and Consultant 48 hours prior to pressure test.
7. Open all mains valves in the test section.
8. Slowly fill mains with water ensuring that all air is expelled at high points.
9. Maximum length of test section shall be no longer than 450 metres unless approved by the City.
10. Raise the water main pressure to 1050 KPa.
11. No pressure drop allowance will made for services.
12. Test duration to be 2 hours.
13. When test duration is done slowly re-pressure the water main to 1050 KPa and record amount of make-up water required.
14. Consultant or City to witness and record pressure and leakage test results on City provided form.

Valve Test

Each section between valves shall be brought to test pressure. Test pressure shall be held without loss for 2 minutes before opening the valve and releasing the pressure into the next section.

The Table Below Summarizes The Allowable Leakage For Each Size Of Pipe:

Ductile Iron & Polyvinyl Chloride Pipe Leakage Allowance Allowable Leakage (litres per 300 m per hour)										
Pressure (KPa)	Pipe Diameter (mm)									
	100	150	200	250	300	350	400	450	500	600
3100	2.42	3.60	4.81	6.02	7.23	8.44	9.65	10.82	12.04	14.46
2760	2.27	3.41	4.54	5.68	6.81	7.95	9.08	10.22	11.36	13.63
2410	2.12	3.18	4.24	5.30	6.40	7.46	8.52	9.58	10.64	12.76
2070	1.97	2.95	3.94	4.92	5.90	6.89	7.91	8.68	9.84	11.81
1900	1.89	2.84	3.79	4.69	5.64	6.59	7.53	8.48	9.42	11.32
1720	1.78	2.69	3.60	4.50	5.37	6.28	7.19	8.10	8.97	10.79
1550	1.70	2.57	3.41	4.28	5.11	5.98	6.81	7.68	8.52	10.22
1380	1.63	2.42	3.22	4.01	4.84	5.60	6.43	7.23	8.02	9.65
1210	1.51	2.23	3.03	3.75	4.50	5.26	6.02	6.78	7.49	9.01
1030	1.40	2.08	2.80	3.48	4.16	4.88	5.56	6.28	6.96	8.36
860	1.29	1.89	2.54	3.18	3.82	4.47	5.07	5.72	6.36	7.61
690	1.14	1.70	2.27	2.84	3.41	3.97	4.54	5.11	5.68	6.81

Expansion Allowance (Polyethylene and HDPE)

The pressure test involves pressurizing the pipe and adding makeup water until the pipe has reached its initial deformation. This level of deformation is usually attained after 3 to 4 hours depending on the size of the pipe. It is characterized by a noticeable reduction in the amount of makeup water required to return the piping system to the test pressure. It is at this time that the actual test period begins. Its duration shall be 2 hours. At the end of the test period, a measured amount of makeup water shall be added to return the pipe to the test pressure. The allowable amount of makeup water shall be determined as follows:

Allowance For Expansion Under Test Pressure [Litres per 30 m of pipe] at 23°C			
Nominal Pipe Size (mm)	1 hour Test	2 hour Test	3 hour Test
75	0.38	0.57	0.95
100	0.49	0.95	1.52
150	1.14	2.28	3.41
200	2.65	4.93	7.96
275	3.79	7.58	11.75
300	4.17	8.72	12.89
350	5.30	10.23	15.92
400	8.33	12.51	18.93
450	8.33	16.29	24.63
500	10.23	20.84	30.31
550	13.26	26.52	39.78
600	17.05	33.72	50.39
700	20.84	42.06	63.27
800	26.52	54.18	85.24
900	34.10	68.19	102.29
1000	41.67	83.35	125.02

The amount of expansion taking place during the pressure testing of polyethylene pipe is dependent on the temperature of the pipe during testing. The temperature of the pipe can be taken as an average of the temperature of the water pumped into the pipe and the temperature of the empty pipe immediately before testing (ambient air temperature). When testing the pipe at temperatures below 23 degrees Celsius, the amount of makeup water should be multiplied by the manufacturer's appropriate correction factor.

Disinfection

The purpose of disinfection is to destroy pathogens (harmful microorganisms) which may be present in the water mains after construction is complete. Chlorine can be introduced into the mains from either a hydrant, service connection or a test port. Ensure that feed point is no more than 3 metres from the beginning of the new water main.

General Procedures for Chlorination of Water Mains

1. Inform City of Whitehorse and Consultant 48 hours prior to test.
2. Ensure that all boundary valves are closed.
3. Open hydrant, service or test port to discharge water as chlorinated water is being fed through main.
4. Feed chlorinated water at a concentration of 50ppm to 100ppm into the water main. Do not introduce a solution of more than 100ppm into the water main.
5. Check that chlorinated water has reached all sections of the main to be disinfected by flushing and testing chlorine residual at each hydrant using an approved field kit.
6. Operate all valves in test section to thoroughly disinfect all appurtenances.
7. Once water main has been thoroughly chlorinated as approved by the consultant or the City, wait a minimum of 12 hours for residual test.
8. Residual chlorine tests are to be taken at a minimum of 2 locations along the main, at every hydrant and must be at least 20ppm after 12 hours. If any residual test is below 20ppm then each section on either side of the failed test and the failed section will require re-chlorination.
9. De-chlorination must be done no longer than 24 hours after chlorination.
10. The contractor must determine how chlorinated water is to be neutralized or disposed and ensure this procedure is acceptable to the City. Under no circumstances will chlorinated water be allowed to be discharged into a sewer system or near a water course.
11. Once de-chlorination is done, low concentration test strips are to be used to confirm that chlorinated water has been flushed out of the mains.
12. Consultant or City to witness and record test results on City provided form.

Sampling

The purpose of the sampling is to ensure that water inside the mains is of a suitable quality for human consumption as determined by Yukon Government, Environmental Health Services. The assumption is that the samples are representative of the water in the water main.

General Procedures for Water Sampling

1. Notify City and Consultant when water samples are scheduled to be taken.
2. A minimum of 16 hours after de-chlorination, the first water sample may be taken.
3. Samples are to be taken by the Consultant or the City with assistance from the contractor.
4. Every sample shall be collected, stored and delivered to Yukon Government, Environmental Health Services (as per their instructions) at #2 Hospital Road.
5. Sampling locations should be done at a service or test port. Hydrants can be used but are not ideal.
6. Samples are required for every 350 metres of water main and one from each end of the main.
7. A minimum of 24 hours after the first samples are taken a second set of samples can be done.
8. If any of the samples produces an unsatisfactory result the main will be flushed and samples re-taken a minimum 24 hours later.
9. If additional test come back unsatisfactory then mains will require re-chlorination.
10. Two complete sets of satisfactory sample results are required before the water main will be activated by the City.

Once all water main testing has been satisfactorily completed and test results signed by the consulting engineer or City Engineering Department, water mains can be activated for public use. **The City reserves the right in the interest of public safety to deny activation of water mains if proper testing procedures have not been followed regardless of sample results.**

CITY OF WHITEHORSE
Water Main Testing

Water Main Testing Must Be Witnessed By the Engineering Consultant or City Representative

Development/ Project Name _____

Contractor _____

Flushing

Date _____

Test Section From _____ To _____

Testing Witnessed By: _____ _____
Print Name Signature

Pressure and Leakage Test

Date _____

Test Section From _____ To _____

Length of Test Section _____ Diameter of Pipe _____

Test Start Time _____ Test End Time _____

Test Start Pressure _____ Test End Pressure _____

Allowable Loss _____ Actual Loss _____

Testing Witnessed By: _____ _____
Print Name Signature

Sketch Area of Water Main Being Tested or Attach Drawing:

Disinfection and Sampling

Development/Project Name _____

Contractor _____

Date of Chlorination _____ Time _____ ppm _____

Date of Residual Test _____ Time _____ ppm _____

Date of De-chlorination _____ Time _____

Date of 1st Water Sample _____ Time _____

Date of 2nd Water Sample _____ Time _____

Testing Witnessed By: _____ _____

Print Name Signature

Sketch Area of Water Main Being Tested:

All Test Results Must Be Submitted To The City of Whitehorse Before Water Main Is Activated

Engineering Office: (867) 668-8305 Office Location: 4210 Fourth Avenue engineering@whitehorse.ca

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This section to be completed by City of Whitehorse Engineering Department only:

Received By: _____ _____

Print Name Signature

Date: _____

Revision #1, 2021

Installation Guide for Power & Communications Systems in Underground Residential and Commercial Subdivisions in Yukon

NorthwesTel

ATCO Electric YUKON

yukon energy

This document was prepared by Northern Power Projects Ltd

Installation Guide for Power & Communications Systems in Underground Residential and Commercial Subdivisions in Yukon

ISBN:

All photos,Luke Horrelt, unless otherwise specified

Disclaimer

This guide outlines the practices that should be followed by the General Contractor hired to install shallow utilities infrastructure on behalf of the authorized users of this document.

The authorized users are: ATCO Electric Yukon, Yukon Energy Corporation and NorthwesTel Inc.

This guide is not designed as a training manual, but contains information, best practices and general recommendations deemed appropriate to perform the work in a responsible and safe manner.

No representation of any kind is made to any persons with regards to the completeness or sufficiency of the information contained herein to perform all aspects of the work.

While a high degree of diligence, including user review, has been applied in the preparation of this document, any and all use of this guide, and the information contained herein, is solely and entirely at the user's risk.

This guide and the information contained herein is proprietary and is intended to be used to conduct the users' business. It is not to be distributed outside the companies of the authorized users without express approval of the author. Inclusion of this guide, or applicable sections thereof, in a construction package (intended to be returned upon work completion) handed out to the General Contractor is approved.

This guide is not a substitute for any utility or outside party documents or publications or any legislated requirements but simply references and provides an interpretation thereof, where applicable.

Author: Luke Horrelt
Northern Power Projects Ltd
May 15, 2021

Signature:

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Preface

The specifications are provided by ATCO Electric Yukon, Yukon Energy Corporation and NorthwesTel Inc. for their respective conduit and equipment installations. The purpose of this guide is to serve as a tool to assist the contractor to achieve the specifications and for the inspector to verify quality and accuracy of the installations.

This guide integrates ATCO, Yukon Energy and NorthwesTel engineering and design work into one format to be used in the field.

This guide is Revision #1, 2021.

As Standards evolve, updated best practices come into effect or other circumstances dictate, the guide will be revised accordingly.

There are several references in this guide to the term “shallows” or “shallow utilities”. This is a construction site term, familiar to users of this guide, to reference the installations of power and communications conduits and equipment as opposed to “deeps” or “deep utilities” which reference installations of sanitary, water and storm lines.

Generally speaking, subdivision construction follows a set sequence:

- Site is grubbed, sub-excavated, pre-graded and roads are layed out
- Sanitary system is installed
- Water system is installed
- Water and sanitary services are installed
- Road base construction is started
- Storm system installed
- Road base construction to pit run level is completed
- **Shallow utilities are installed**
- Road base construction continues to final pit run level
- Surface works starts, curb and sidewalks are completed
- Road base construction continues to Gran A & B level and is final graded
- Asphalt road surface is completed
- Lots are graded to final elevation
- Property pins, lane pins, and all remaining surface works (bollards, street signs)

Roles and Responsibilities

In a project of this type, there are several parties involved. This section references the parties involved at the construction stage.

Owner

- This role is usually assigned to the developer and is normally filled by the territorial government.
- Municipal government(s), First Nations government(s) or a private party may also assume this role.

General Contractor

- Responsible to carry out construction activities in accordance to the terms and conditions of the contract signed with the Owner.

Contractor Site Superintendent

- The person in charge of construction forces on site.
- Responsible to carry out duties assigned by the General Contractor. This includes, but is not limited to, scheduling, work sequence, hours of work, production and quality control, site safety, site security, etc. All parties not normally working on site on a daily basis must report to the Site Superintendent upon entering the site.
- Liaises with, and takes direction from, the Engineer's Inspector as required.

Shallow Utility Foreman

- Answers to, and takes direction from, the Contractor's Site Superintendent.
- Responsible to install electric and communication utility civil infrastructure to the specifications provided by the utilities.
- Responsible to install conduits and equipment to the exact locations and elevations provided by the Site Surveyor's reference stakes.
- Directs the activities of the "install" crew and "backfill" crew.
- Liaises directly with the Site Surveyor and Shallows Inspector.

Engineer of Record

- Acts as the Owner's agent with respect to representing the Owner's interests.
- Responsible to provide interpretation and enforcement of the contract's terms and conditions.
- Responsible to prepare overall subdivision construction plans and "as built" plans.
- Settles disputes or claims between the General Contractor and the Owner.
- Processes progress payments and approve invoices.
- Monitors and reports on progress and site conditions.
- Authorized to make changes on site and approve any deviations.
- Directs the activities of the Site Surveyor.
- Leads the weekly site meetings.

Engineer's Inspector

- Acts as the Engineer of Record's agent on site.
- Liaises directly with the Contractor's Site Superintendent, the Shallows Inspector, Site Surveyor and sub-contractors.
- Has authority to approve or direct deviations; identifies and tracks deficiencies and orders remediation; verifies progress payments; monitors and reports on progress relative to the contractor's schedule; continuously monitors the entire site and notes (and reports on) any site security or site safety infractions.

Site Surveyor

- Responsible for any and all survey layout activities. Usually answers directly to the Engineer of Record or Engineer's Inspector depending on the need.
- May also be contracted, in part, directly to the General Contractor.
- Lays out all equipment locations and elevations (including shallow utilities, street signs, etc.); lays out all surface works including curbs, sidewalks, trails, roads, lays out overall site grading; lays out deep utility infrastructure; lays out shallow utility trenches.
- Responsible to pick up and record as built information, pick up and/or verify contract quantities for progress payment.
- Liaises directly with the Contractor's Site Superintendent, the contractor's surveyor, the Engineer's Inspector, the Shallows Inspector and the Contractor's Shallow Utilities Foreman.
- Works with the Shallows Inspector to provide conduit locates on request.

Shallow Utilities Inspector

- Acts as the agent on site representing the interests of the Electric and Communications utilities.
- Responsible to ensure utility infrastructure is installed to the specifications provided by the utilities.
- Acts as a resource to the Shallows Foreman to assist in interpreting the specifications and provides assistance to achieving a quality product.
- Records and documents as built information. Provides the utilities with photo records and weekly site reports.
- Directs any field enhancements and liaises directly with the utilities on any matters of concern.
- Ensures deficiencies are identified and corrected.
- Provides locates in accordance with the “Locates” section of this guide.
- Liaises daily with the Shallows Foreman, the Engineer’s Inspector, the Contractor’s Site Superintendent and Site Surveyor.
- Performs other duties as assigned by the utilities such as, but not limited to: excavation and physically supporting existing electric and communications utilities to facilitate deep utility tie-ins, electric utility tie-ins to existing energized equipment, riser pole construction, pole support, etc.
- Attends the contractor’s daily Tailgate meeting and provides relevant input as required.

Orientation, Locations, Alignment, Elevations

It's common practice to align the main shallow utility trench under the sidewalk in URD subdivisions or under the paved trail.

This rule can vary depending on whether the trail is "meandering" or if in an area where no sidewalk is present.

The main line, electric utility high voltage trench, is aligned on the opposite side of the street from the deep utility water line.

The site surveyor will stake trench centerline. If working in an area that has a sidewalk and trench is staked other than under the sidewalk, this should be questioned and discussed with the Engineer's Inspector. This type of alignment can pose difficulties for the surface works contractor with respect to pounding concrete form guide pins.

In all cases, it is the responsibility of the Shallows Foreman and the Shallows inspector to ensure that no equipment or buried conduits or buried ground grids are installed on or inside property lines. The Site Surveyor, on request, will provide property line information.

Due to the "compressed" nature of current subdivision design, crowding is the inevitable result. If within 300mm of the property line, keep in mind that property owner will/may install perimeter fencing and 1m-long property pins will be installed at a later date. There are steps that can be taken to mitigate, e.g. install an 8-inch Sonotube.

Sonotube is installed outside of conduits and ground grid, the 1m-long property pin will be installed inside Sonotube.

Proper vault and TV2500 setting elevations

In general terms, the transformer vault opening, the Joint Use pedestal "power" compartment and NWTel AG-6 pedestal doors should face the sidewalk.

On designated "green" streets, closed to vehicle traffic, it's acceptable to have the transformers and pedestals face the street.

Street lights are oriented to be perpendicular to the driving surface. Note curb orientation can vary in places, ("elephant ears") ignore this. This is not so important on decorative-type lights but is very important on "cobra head"-type lights.

The Site Surveyor will provide offset staking for the equipment locations, orientations and setting depth.

The Site Surveyor uses GPS enhanced survey tools. The Shallows Foreman uses traditional survey tools, e.g. tape measure, electronic and/or optical/bubble based level tools.

The Shallows Inspector may, or may not, depending on the situation, accept a deviation within 25mm and under horizontally and vertically. Any variations or deviations greater than 25mm is a deficiency and must be corrected.

In all cases, equipment is to be set level, with no tolerance for deviation.

This is a critical component of shallow utilities civil works construction and will be discussed in depth in the “Field Enhancements” and “Elevations” sections.

If any confusion arises, the Shallows Foreman and the Shallows Inspector should be discussing this and bringing it to the attention of the utility’s reps and the Engineer’s Inspector for clarification as required.

The logic behind the equipment orientation is to provide a safe work zone, away from traffic, for utility technicians and has the added benefit of allowing access to the front of the equipment unobstructed by snow plowing activities.

Equipment locations within the subdivision are known as “sites” and will have a separate drawing for each site. The site number should be clearly marked on the equipment, below ground level, with a large tip black permanent marker. After site construction, and prior to backfill, the site should be photographed, clearly showing the reference number. Photos taken without a reference to the construction plan are generally useless.

1. *TV2500 and TX vault are numbered*
2. *Orange pipes cross over red*
3. *Vault opening covered w plywood*
4. *Empty “mouseholes” covered to prevent sand pouring into vault*

The site drawing will show equipment and conduits and how the various pieces are connected. Be aware this drawing is not to scale. Each site drawing needs to be signed off as “as built” and dated. Any changes made to this drawing should be discussed in advance between the Shallows Foreman and Shallows Inspector.

Draw the changes in red pen. More on this in the “Field Enhancements“ section.

Elevations

This is a key component of this type of construction project and can have considerable financial and operational impact if not done properly.

The Site Surveyor will provide elevations for each piece of equipment. It’s vital that the Shallows Foreman and the Shallows Inspector understand the logic behind these given elevations.

The elevation points given to the surveyor are derived from the site plans, in other words, these points are determined well in advance of construction and are not derived from actual on-site, pre-construction conditions.

The Surveyor will provide this data based on “final elevation” on his offset stakes and nails. The Shallows Foreman installs the equipment to the setting depth indicated on the specification drawings issued by the utilities, referenced to “final elevation”.

The utilities provide depth of burial to ensure water ingress in the vaults is minimized, allows for future landscaping (this is considered to be 75mm topsoil plus 75mm to mowed grass level), allows for equipment access panels to remain accessible above ground, allows for street light mounting bolts to be left exposed, etc. In other words, the utilities will take into consideration what is the **Finished Elevation**.

Final Elevation

This term can mean different things to different people. But for the Shallows Foreman and the Shallows Inspector it should be taken as:

- Equipment, including streetlights, placed in the boulevard between curb and sidewalk; take as final elevation a line drawn between top of sidewalk and top of curb

- Equipment, including streetlights, placed between sidewalk and property line; take as final elevation top of sidewalk
- Equipment installed alongside a paved trail; take as final elevation, top of asphalt
- Streetlights used to light the trail; take as final elevation top of asphalt, if a paved trail
- Streetlights used to light the street installed between a paved trail and roadway; take as final elevation a line drawn between top of curb and top of paved trail
- Streetlights installed in an "island" final elevation is taken from a line drawn top of curb to top of curb, regardless if there is a vertical offset between the curbs

In all cases, the Shallows Foreman and Shallows Inspector need to take into consideration what the **finished** subdivision will actually look like, i.e. it's very unlikely the future lot owner will grade his lot lower than sidewalk or trail elevation.

This is a judgment call.

It's fairly easy to judge if terrain is relatively flat and much more difficult to judge if terrain is sloped. Consult with the Engineer's Inspector for clarification if necessary. The rule of thumb is: "It's always better to be a little high than a little low".

When shallows are installed there is usually no curb or sidewalk to go by. This information can be gotten from the Surveyor.

If something doesn't look quite right, question it. There have been instances where equipment elevations provided by the Surveyor have been inaccurate.

This usually leads to the contractor having to raise equipment, at his cost, at a later date when concrete works have been installed and the setting error becomes readily apparent.

In all cases, equipment elevations, locations, orientations are recorded and verified by the Surveyor prior to any backfill.

1. *Proper setting elevations for switch cubicle and street light, Tel pedestal*
2. *As well, note: the switch cubicle is oriented such that the switch operator is not standing in traffic*
3. *Surveyor records elevation of vaults prior to backfill*

Trenching and Backfill

Typical cross section of subdivision road construction used in Whistle Bend, as an example:

1. 800mm wetted and compacted sand, 98%
2. 500mm pit run (6-inch minus), wetted compacted, 98%
3. 200mm Gran “B” (2-inch minus), 98%
4. 150mm Gran “A” (3/4 minus, commonly called “road mix”), 98%
5. 75mm asphalt

These numbers can change depending on road base material, road classification, etc.

Construction, to install shallows installations, should start at pit run level. This should leave approximately 425mm above pit run to final elevation.

Implies that, trench construction bottom (after first level of sand) is typically at 800mm minimum, top of conduit ends up 700mm below pit run level.

Makes the final conduit dept about 1125mm under asphalt and a bit deeper under sidewalks.

This is the minimum standard to follow as it must be considered that the pit run layer will be smoothed out (graded) and a large drive on roller packer will prepare the road base for subsequent layers.

Based on data obtained in the field over several years, .7m of cover is adequate to ensure ducts don’t get damaged (or “ovalled”).

- Trench centreline is laid out by the Site Surveyor. Minimum Code separation any conduit to vertical concrete structures (catch basins, manholes, etc.) is .3m. However, it’s best if a 1m separation can be maintained. Separations between deep and shallow utilities will be discussed in more depth in later sections of this guide.

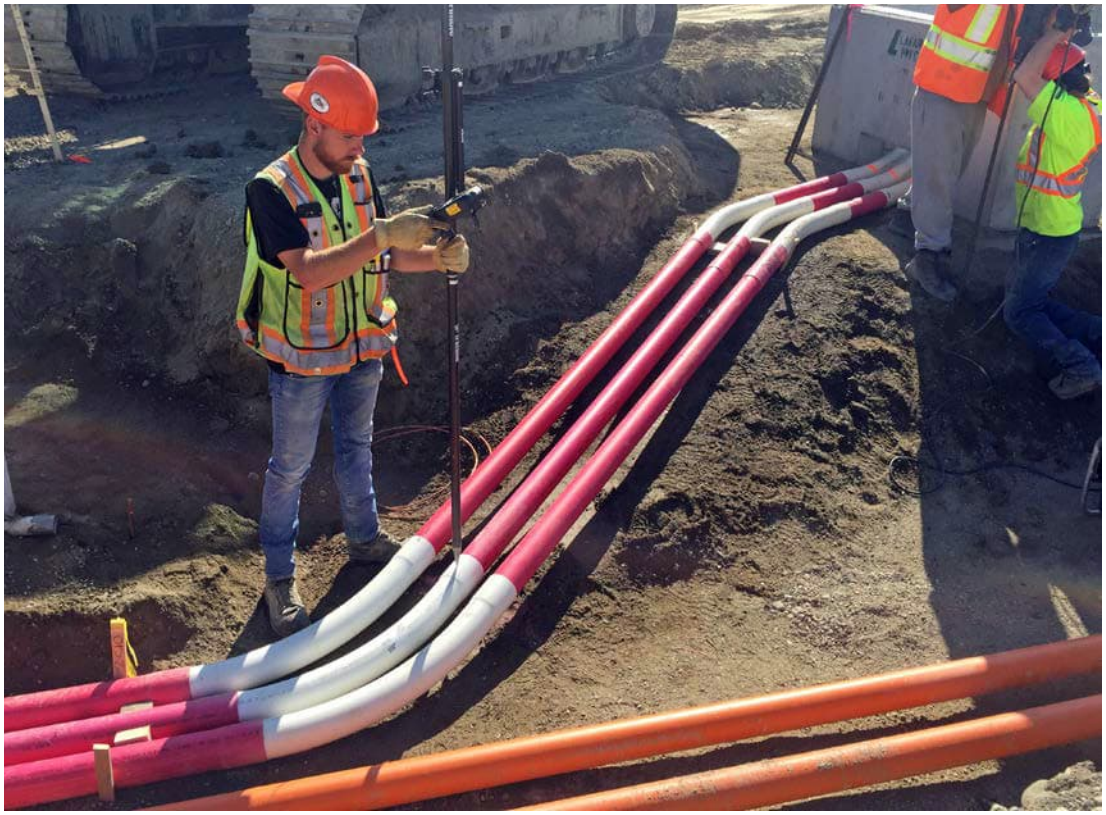
- Trench is excavated to proper depth using **smooth edge bucket**. Trench is of sufficient width to accommodate the number of ducts in the trench which can vary from 1 up to 10 or more. Note also that trench should be wide enough to allow room for workers to walk up and down the trench without having to walk on the ducts themselves. Walking on loose ducts is hazardous and can easily lead to injury.

Note: Trench width to allow safe worker access, trench top edges pulled away, conduits properly spaced

- Trench bottom is to be as level and smooth as possible: loose rocks picked out, sand layer installed, wetted, packed with plate packer and raked to avoid humps and dips. This allows conduits to lay as flat as possible.
- Conduits are installed according to spec. See next section for more detail.
- **Note: It's very important at this stage to closely inspect the ducts to ensure absolutely no rocks have fallen in under the conduits.**
- Next, a light layer of sand is installed. This layer is no deeper than top of conduits. This layer is raked flat along top of conduits and rake handle (note: a 1x4 in board can also be used) is used to poke between the conduits ensuring the gap is filled. Ensure ducts are supported by sand underneath. Tops of all conduits should be clearly visible at this point. Typically, the backfill crew will use the back of the rake to finish this part. This step is called "pre-sanding".

1. *Separation between red and orange ducts*
2. *Ducts are staked in place*
3. *2 workers behind the excavator are tamping sand between ducts*
4. *Duct ends are capped*
5. *Sand is packed between ducts*
6. *"AB" is painted on the bank showing surveyor has recorded "as built"; site now ready for sanding and backfill*

- At this point, the Surveyor is called in to record “as built” information. The Surveyor is also called in on occasion before pre-sanding. This can be decided in the field. **Regardless, ducts are not to be covered without inspection and survey record**. Only the Shallows Inspector can authorize backfill.



Note: Conduit runs are picked up by the Site Surveyor and provide an accurate 3D locate. Power and communication duct runs are picked up separately. All survey data gets transferred to the Engineer of Record’s site plan.

- Next layer of sand installed. It is common practise go with the length of the shovel head to assure a uniform and adequate sand cover.
- Sand is wetted and packed with plate tamper. Try to get ducts sanded as quickly as possible as the longer the trench is open, the more rocks inevitably fall in as trench walls dry out.
- Install first lift of pitrun (or common, if not under structure), 350mm thick maximum (to avoid “ovalling” the ducts), wetted and packed with 500–750lb walk behind packer. Pick out any rocks bigger than 150mm.

- Test to 98% SPD. The Shallows Inspector or the Shallows Foreman should be present at this test as it is very easy to punch the probe pin through the ducts.
- Install utility marker tapes, letters facing up. If only 1 utility in the trench, use appropriate marker tape. The installation of marker tape signals to the backfill crew that the trench is ready for the next lift.
- Install subsequent layers to top of trench, wet and pack, test to 98%. Can be packed with heavier compaction equipment (e.g. 1000lb walk behind packer) but not the large road construction packers yet.

Note: Red tape over red pipes; orange tape over orange

Note: Sand imported to the site needs Engineer of Record's approval (this is typically sub-contracted to EBA) and utility approval. Sand with high clay content or too many rocks or too coarse will not be permitted for conduit bedding.

Utility specs call for a minimum of 150mm compacted sand encapsulation of the ducts.

Any and all deviations to the trenching and backfill guideline will be pre-approved by the Engineer's Inspector and the Shallows Inspector.

Concrete

Minimal depth of bury, by Code, for communications and low voltage (120/208/240 volt) electrical is 600mm.

Minimal depth of bury for both electrical and communications conduits according to utility and City Servicing Standards is 1m.

Minimum standard in Yukon subdivisions is 1m burial depth for all conduits.

Actual depth is measured and recorded by the Site Surveyor. Any conduit that is not at the minimal depth is a deficiency and must be corrected.

There are exceptions.

As the Whistle Bend subdivision, for example, is very flat, the storm pipes are fairly shallow and can conflict with shallow utilities conduits; particularly, but not limited to, road crossings.

Code requires shallow utilities conduits crossing within 300mm of deep utility pipes (usually storm) to be concreted.

Where possible, the trench should be deviated to avoid crossings, usually CB leads.

Any such trench deviation will be pre-approved by the Engineer's Inspector and the Shallows Inspector.

Where it's not possible to deviate the trench, the contractor will have to concrete the crossing for 2 reasons: first, if the separation must be within 300mm, and second, if the pipes can maintain 300mm separation but will cause top of conduit to top of existing pitrun grade (note: pitrun grade may not be at final spec; happens on occasion) to be less than the .7m minimal depth that permits the large drive on road prep packers.

The usual method of concreting a crossing is to expose the storm pipe, confirm elevation with the Site Surveyor and the Shallows Inspector, install a 2x4 block between each conduit and storm pipe then pour at least 150mm concrete cover extending to at least .5 m on each side of the storm pipe. Ensure concrete completely encapsulates the individual conduits. Take photos and let set overnight.

It's normal to discuss with the Engineer's Inspector prior to installing concrete.

There is a third reason to install concrete. Usually this is done if certain reasons dictate that the 1m required burial depth cannot be achieved. This is rare but does happen. An example of this is the main line crossing on Witch Hazel (Whistle Bend) involving the 2 bioswale pipes. These issues are usually discussed between the Shallows Inspector, the Contractor's Site Superintendent, the Shallows Foreman and the Engineer's Inspector. Code does permit a .5m final burial depth with adequate concrete measures taken.

It would be normal in this case to also get approval from ATCO, YEC and NWTel Engineering, as applicable.

1. *Concrete extends beyond the ducts*
2. *In some cases, a 20mil poly sheet is laid down prior to concrete*
3. *A 2x4 block is placed between conduit and storm pipe to allow concrete to flow under*

Conduits

Conduits are **RED** for power systems and **ORANGE** for communications systems. This is the universally accepted Code standard.

For residential services, there is 1x4 in red conduit and 1x2 in orange conduit provided to each lot. The conduit stub-off detail is provided by the utilities.

1. *2 in orange residential Tel service*
2. *4 in red Power service*
3. *Lot numbers are marked; corresponding conduits are marked in service pedestals*

For commercial services there is usually 1, 2 or 3x4 in red and orange conduits provided to each lot. Consult the respective utility's construction plans to ensure the right number of conduits.

Note that power and communications services are 4-inch.

Street lights are connected via a 2 in red conduit.

1. *Red conduits under orange communications conduit*
2. *Streetlight base is marked*

Code dictates a 50mm horizontal separation between conduits of the same colour and a 100mm separation between red and orange conduits in the trench. This separation is achieved using 2x4 blocks cut in 100mm lengths and the conduits are staked in place at the bottom of the trench.

Staking the conduits ensures:

- Spacing is to Code
- Actual conduit location reflects the surveyed “as built” record
- The sand tamped into the space between conduits acts as support to help dissipate compaction forces and prevents ducts from “ovalling”

Note:

1. *Conduits are spaced to Code and staked in place*
2. *Conduits are individually identified*

To ensure a good bond, conduit to conduit, wipe the ends clean with a rag to remove dirt, moisture and cutting dust and apply glue to both ends, push together till the conduits bottom against the bell taper.

The glue reacts negatively to frost, snow, cold and moisture. If conduit ends are not dry, the glue will not set and turns to a white milky substance easily seen at the glue seem. If this is the case, the **bond is a deficiency** and must be corrected prior to backfill.

Note white glue residue at the seam

Setting time can vary; when it's hot, maybe 3 seconds. Setting time increases as temps drop.

Conduits are cut using a Stihl carb saw or equivalent. This ensures a clean cut. Using "Sawzall" or hand saws is to be discouraged.

Conduits that are cracked or dented are not to be used. It's normal practise to cut out the damaged parts and use the good remaining sections. This helps on material costs and minimizes conduit scrap thrown in the landfill. The utilities will provide a special pipe splice for this application.

All conduits, except streetlight feeds, are to be properly identified at the end of each run using a black permanent thick marker. If unsure of the identifying marks, consult with the Shallows Inspector.

Note:

1. *Proper spacing and staking*
2. *Ducts are capped at the end of the day*
3. *All ducts are marked*

Conduit runs are planned by the Shallows Foreman to take into consideration how the conduits enter and exit each equipment (sites) location. Conduit runs are planned so that there are no “crossovers” mid trench. Crossovers are only permitted at the “sites” and only 2 pipes may cross. Crossovers with 3 pipes will lead to inadequate depth, possible conduit damage and difficulty achieving compaction specs. **3 pipe crossovers are a deficiency**.

In general, orange pipes cross over red pipes. The accepted practise is to install red pipes first then the orange ones. It can happen where you must cross a red over an orange pipe. In most cases this is done to avoid a 3-pipe crossover. Usually this happens when 1 or more pipes bypass a site where lot services are involved or at road crossings and 4-way pipe intersections.

Red pipes can carry either high or low voltage. This can make a difference if the Shallows Inspector will accept a crossover not to spec. Consult with the Shallows Inspector if in doubt.

Crossovers are inevitable. Good planning and practise will minimize the amount of crossovers.

Note how orange conduits are placed to allow pedestal entry minimizing crossovers. Note also how they come out of the pedestal in a planned manner for the next site. Orange over red is the rule.

When forced to extend a spigot–spigot ended conduit, use only a pipe splice on buried conduit; extending stub-offs or extending conduits in a service pedestal the traditional short white coupler is to be used. I**t's a deficiency to bury a white pipe coupler.**

Note: White coupler only used to extend service stub off and pedestal extension.

When the trench route calls for a shallow curve or bend, sometimes it's possible to install the conduits without using 22's or 45's. Each preformed bend adds pulling tension to the cable installation process. On short runs this can be ignored but on long marginal "pulls" it can make a difference. To achieve a shallow bend, glue together 3 lengths of pipe outside the trench and use 2 or more workers to lay them in the trench avoiding spilling rocks in the process. This is another advantage to staking the conduits in place. Done right, this procedure can look very professional. Consult with the Shallows Inspector for assistance in determining if this method is appropriate to your location.

Note conduits curved and staked in place.

When leaving the site overnight or if it starts to rain, it's necessary to cap the pipes to prevent moisture, mud or gophers from entering.

Note: When ducts end on the straight end, you can use a cap. When ending on the bell end, use a short piece of conduit and a cap. **Do not glue caps!**

Pulling Strings

The utilities' specifications will stipulate that the contractor clean and "proof" the ducts and install pulling strings.

Proofing the ducts implies that the conduits are undamaged, clean of construction debris and actually end up exactly where each individual duct is supposed to go according to the construction plans. Proofing the ducts is part of the utilities commissioning process.

Pulling strings are provided by the utilities in plastic pails.

In the past, it was common practise to blow in a string, using a shop vac or gasoline-powered leaf blower tied to a bunched up plastic bag then pull in a 4-inch conduit brush w a rope and a string tied behind.

This is an expensive and ineffective process. Ineffective because ducts can be deformed or broken during backfill/compaction testing process impeding cable pulling operations, even though a bunched-up plastic bag may blow past relatively easily. Expensive because of extra time required creating duplication of string installation process.

The preferred method is to use factory-built equipment specifically designed for this purpose.

This consists of a special blower apparatus and assorted fittings to enable a tight seal to the duct opening. The string is attached to a specially designed "conduit piston" consisting of a foam body sandwiched between 2 hard plastic disks. The disks are sized to allow only about a 6mm "out-of-round" tolerance. The foam body expands to provide an air tight seal inside the duct. This maximizes efficiency of the "blowing" power and is highly effective at cleaning the ducts of sand, water, rocks, critters and cutting dust.

Assuming the conduit system is properly built and using equipment specially designed for this purpose, string blows in excess of 400 meters are easily achievable.

Greenlee Canada is a builder and supplier of this equipment. They have a website and an online store.

Street Light Bases

These bases typically come in 3 lengths; 5, 7 and 9 foot. The utility will specify what type of base is to be installed on the work drawings.

There are 3x2-inch steel feed conduits and a ¾-inch black PVC ground conductor conduit built into each base.

The base is prepped prior to installation by using duct tape to cover all conduits.

For all bases, the setting elevation above final is the same as the measurement from top of base to feed conduit is constant. Only the depth of excavation varies.

Setting elevation is 100mm above final elevation, measured on the flat side of the base to bottom of bevel.

To install these, excavate to depth allowing enough room to install at least 100mm drain rock.

This depends on the nature of the ground and should be discussed with the Shallows Inspector. For example, if installing in blue clay, excavate at least 700mm deeper, install a layer of pit run and pack with Jumping Jack before installing the drain rock.

Note: Blue clay layer, must be excavated, filled w pit run and packed w Jumping Jack before installing base

The rock ensures base is set on a solid footing and helps maintain proper elevation when levelling the base.

The base is lifted by the excavator bucket, connected with a suitable cable sling to a contractor-supplied, base-plate device.

Base is oriented square to the driving surface. This is determined from the Surveyor's offset stakes.

Once base is in place and prior to backfill, the Surveyor will check for proper elevation and alignment and record the data.

Leave enough room in the excavation for compaction equipment to go completely around the base.

It's common, on a 5-foot base, to backfill with sand to just below conduit level. Sand is wetted and packed.

On the longer bases backfill with "common" or pit run depending on the quality of the excavated material.

The objective is to ensure base is solidly set and won't lean in the future.

The work drawings will show how many conduits attach to each base. Orientation of the base needs to take this into account to ensure feed conduits can be easily connected.

There is a utility-supplied coupler which connects the steel-threaded pipe to the 2 inch DB2 red duct. This coupler has a small and loose glue surface; it's not the best system. The accepted method of connecting the 2 inch is to glue it in place and wrap the connection with a couple layers of rubber self-amalgamating tape. This tape is supplied by the utility for this purpose.

The utility is aware that the coupler has short comings.

Grounding details for streetlight bases are provided by the utility.

Note:

1. *Conduit connection at base is taped*
2. *Streetlight base is numbered*
3. *Top conduits are covered w Duct tape*

Joint Use Pedestals

These pedestals have 2 compartments, one for communications and one for low voltage power cables.

These pedestals are used to provide lot services. It's normal practise that 4 lots are serviced from each pedestal, though that can vary from 3 to 5. Pedestals also provide a connection point for streetlight feeds.

Power supply for the pedestal comes from the transformer. Communications supply usually comes from a TV2500 or AG-6 Telephone pedestal.

These units come with 4 legs that must be bolted on. Legs are provided separately and bolts are in a bag inside the pedestal. Legs are bolted on with the legs inside the pedestal.

To install the pedestal, the site is excavated to the location and depth pre-determined, derived from the Surveyor's offset stakes and elevation nails. 150mm drain rock layer is installed and raked flat. Pedestal is set in place, by hand, with all 4 legs on the drain rock base. Pedestal is levelled. The Surveyor checks that elevation and orientation is correct and records the information. 200mm sand is installed and raked flat around and under the pedestal usually extending .5m beyond the legs. Sand is wetted and a 200lb plate packer is used to compact the sand and firm up the unit to accept conduit installation. Re-check level, adjust and re-compact as necessary.

Proper setting depth to final elevation is 25mm above the topmost leg mounting bolts.

Pedestal is grounded to the spec provided. Leave a loop of #2 copper coiled inside the power compartment.

Install power conduits first, then communications using 90-degree conduit bends. Extend all conduits, using white couplers, to a point 25mm below pedestal opening with access doors removed.

All conduits are labelled and left un-capped. Pedestal access panels are installed and securing bolts are coated with "Never Seize".

The immediate area all around the pedestal is backfilled with wetted, compacted sand to final elevation.

It's very important to ensure no rocks or sand enter the ducts while backfilling!

Note:

1. *Legs set in drain rock*
2. *All conduits identified*
3. *Grounding loop in place*
4. *Pedestal is identified*

This is a typical 4 service, 1 power feed, looped communication feed, joint-use pedestal installation.

Note:

1. *Pedestal is properly secured in place*
2. *Orange ducts cross over red*
3. *Site is identified*
4. *Grounding not yet in place*

Single Phase Transformer Vaults

The single-phase transformer lowers the high voltage distribution system (14,400-7200 volts) to the low voltage (120/240 volts) residential service.

The transformer sits on a concrete vault. Fibreglass vaults were used in the past, but this standard has now been up-graded. To install the vault, excavate enough to allow clearance for ground grid and compaction equipment all around the vault. Excavate to depth to allow vault to sit on a 300mm bed of drain rock. The rock is raked flat to allow the vault to sit level. The opening at the top of the vault is oriented towards the sidewalk.

Top of vault is set at 200mm above final elevation.

Vault is lifted into place with the excavator using a 4-point cable sling (rated) attached to factory-installed lifting loops. Chains are not to be used for this purpose.

The weight of the vault is provided on the specification drawings.

The Surveyor verifies setting depth and orientation and records the information.

Typically, there will be a high voltage duct entering and exiting the vault, along with 2 pedestal feeds and 2 lot services and 1 or more streetlight feeds.

Ducts will enter the vault using 22.5-degree bends and extend approximately 150mm inside the vault.

Vault is grounded to the specification provided.

Once all conduits are in place, install covers over the conduit openings (“mouseholes”) to minimize contaminants intrusion into the vault. Backfill as outlined in the previous “Trenching and Backfill” section.

Ensure all conduits are labelled and capped.

Leave a plywood cover over the vault opening for safety reasons and to avoid filling the vault with backfill material, snow and water.

Note:

1. *Plywood covers on top and opening and at "mouseholes"*
2. *Drain rock base*
3. *Conduits enter at an angle and are identified*
4. *Vault grounding not yet done and caps not yet in place*

Note: Single-phase transformer vault may also be used as a base for a three-phase commercial service pedestal. Installation method is the same but grounding specifications will be different. Vault is usually, but not always, installed very near the three-phase transformer vault

Three Phase Transformer Vaults

The three-phase transformer lowers the high voltage distribution system (25,000–12,500 volts) to the low voltage (120/208 volts) commercial service.

The transformer sits on a concrete vault.

To install the vault, excavate enough to allow clearance for ground grid and compaction equipment all around the vault. Excavate to depth to allow vault to sit on a 300mm bed of drain rock. The rock is raked flat to allow the vault to sit level.

Top of vault is set at 200mm above final elevation.

Vault is lifted into place with the excavator using a 4-point cable sling (rated) attached to factory-installed lifting loops. Chains are not to be used for this purpose.

The weight of the vault is provided on the specification drawings.

Surveyor verifies setting depth and orientation and records the information. Typically, there will be 3 high voltage ducts entering and exiting the vault, along with 1 or 2 services, though this configuration will vary according to the unit's intended purpose and location.

Ducts will enter the vault using 22.5-degree bends and extend approximately 150mm inside the vault.

Vault is grounded to the specification provided.

Once all conduits are in place, install covers over the "mouseholes" to minimize contaminants intrusion into the vault.

Backfill as outlined in the previous "Trenching and Backfill" section.

Ensure all conduits are labelled and capped.

Leave a plywood cover over the vault opening for safety reasons and to avoid filling the vault with backfill material, snow and water.

Note:

1. *Drain rock base*
2. *Site identified*
3. *Ground rods installed but not yet connected*
4. *Lifting slings*

Switch Cubicle and Switch Modular bases

These three-phase units are used to switch circuits on the high voltage distribution system and can serve other purposes as assigned by the power utility.

These units sit on a concrete vault.

Some vaults are 2-piece, the bottom section serving as a base.

To orient these vaults, it's necessary for the Shallows Foreman and the Shallows Inspector to discuss the installation in advance as these vaults may not always be square and installation is based on how the equipment access doors are oriented.

To install the vault, excavate enough to allow clearance for ground grid and compaction equipment all around the vault. Excavate to depth to allow vault to sit on a 300mm bed of drain rock. The rock is raked flat to allow the vault to sit level.

Top of vault is set at 200mm above final elevation.

Vault is lifted into place with the excavator using a 4-point cable sling (rated) attached to factory-installed lifting loops. Chains are not to be used for this purpose.

The weight of the vault is provided on the specification drawings.

Surveyor verifies setting depth and orientation and records the information.

Typically, there will be 12 high voltage ducts entering a switch cubicle vault.

Ducts will enter the vault using 22.5-degree bends and extend approximately 150mm inside the vault.

Vault is grounded to the specification provided.

Once all conduits are in place, install covers over the "mouseholes" to minimize contaminants intrusion into the vault.

Backfill as outlined in the previous "Trenching and Backfill" section.

Ensure all conduits are labelled and capped.

Leave a plywood cover over the vault opening for safety reasons and to avoid filling the vault with backfill material, snow and water.

Note:

1. *Ducts enter at a 22.5-degree angle*
2. *Capped and identified*
3. *Ground wires*
4. *12 ducts in each vault*
5. *Drain rock base*
6. *"Mouseholes" covered prior to backfill*
7. *Site is identified*

TV2500 Pedestals

These are single compartment pedestals for the exclusive use of the communications utility, NorthwesTel. They provide a separation point for pulling cables and/or an interface point between the larger trunk cables and residential or commercial services.

They are typically installed at all single-phase transformer “sites” within a residential subdivision but can also be installed as stand alone.

Note: This is a stand-alone TV2500 installation. Pedestal has separate grounding, orange pipes cross over red, proper setting depth. Site number is clearly referenced.

There are access doors on both sides to facilitate orientation.

They are supplied with 2 legs that must be bolted on before installation. They have a built in threaded insert to facilitate assembly but it's best to add a flat washer, lock nut and threaded nut to properly complete the assembly. Reason being that if the bolt is even slightly over-tightened the threaded insert will pop loose.

Setting these pedestals in place is a somewhat challenging procedure, as the standard legs are 500mm too short from the factory to accommodate proper setting depth in relation to the bottom of the conduit trench. (Note: NWTel is aware of this issue and are working to address.)

The Site Surveyor will provide offset stakes and elevation references.

The preferred installation method is to build up a "mound" of bedding sand, wetted and packed in layers with 200lb plate packer. The height of this mound is not an exact measurement, and will be determined by the contractor through practise and experience.

The purpose of the mound is to permit the legs of the pedestal to be pushed in deep enough to both, achieve proper setting depth and to support the pedestal in place while conduits are installed.

Proper setting depth for a TV2500 pedestal is a point halfway between the bottom of the access door opening and the bottom of the pedestal referenced to "final" elevation.

The sand mound is carefully carved away to allow conduit installation.

Conduits enter the pedestal from underneath via a 90-degree conduit bend. Extensions are added, similar to those in a Joint Use pedestal, using the white couplers to extend them to approximately 25mm below the access door openings. All conduits are labelled and left un-capped.

Install ground wire as outlined in the "Grounding" section.

Pedestal location, elevation and orientation must be verified by the Site Surveyor and approved prior to backfill.

To backfill, first install sand around the conduits and place common fill around the pedestal firmly packed with 200lb plate packer. Finish off the top lift with the larger trench packing equipment.

Ensure there are no rocks near or in between the conduits.

Ensure no rocks or sand enter the ducts while backfilling.

Ensure pedestal is installed level and that doors open and close smoothly.

Due to construction and operational “inadequacies” identified with the use of this type of pedestal, NWTel is phasing out this application for residential subdivision construction in favour of the AG-6 pedestal.

Note how the sand mound is carved away to allow duct entry

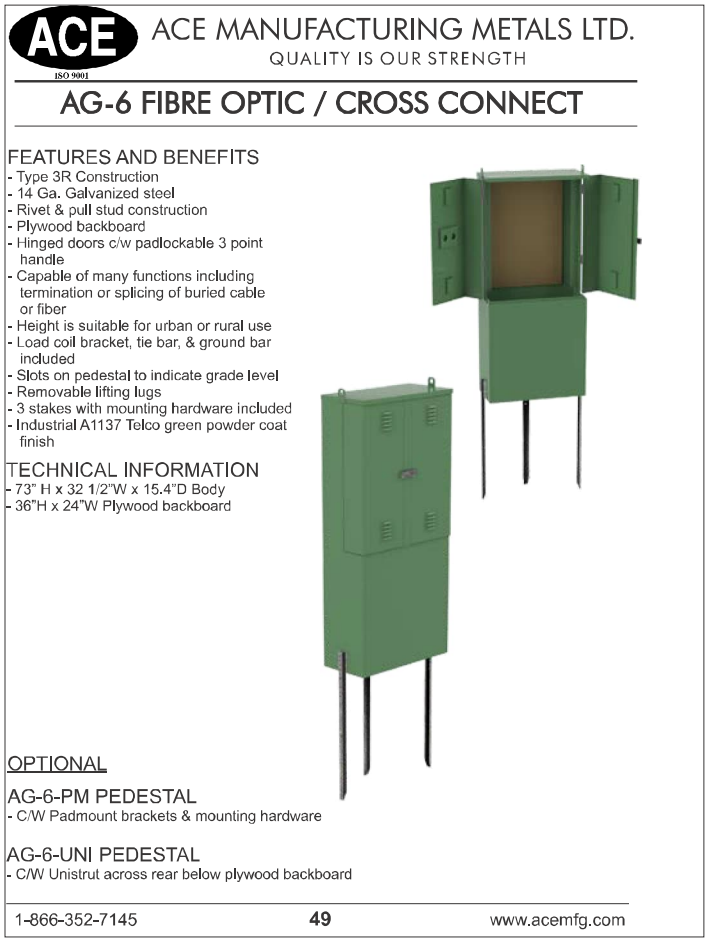
NWTel AG-6 Pedestal

These are single compartment pedestals for the exclusive use of the communications utility NorthwesTel.

This type of pedestal will be the standard pedestal used for residential subdivision construction and is intended to replace the TV2500.

They provide a separation point for pulling cables and/or an interface point between the larger trunk cables and residential or commercial services.

They are typically installed at all single-phase transformer “sites” within a residential subdivision but can also be installed as stand alone.



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- 3 stakes with mounting hardware included
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- 36"H x 24"W Plywood backboard

OPTIONAL

AG-6-PM PEDESTAL
- C/W Padmount brackets & mounting hardware

AG-6-UNI PEDESTAL
- C/W Unistrut across rear below plywood backboard

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Note: This is the drawing for the AG-6 pedestal.

There are access doors on one side only, which affects orientation.

They are supplied with 3 legs that must be bolted on before installation. Legs and mounting bolts are supplied inside the pedestal.

The Site Surveyor will provide offset stakes and elevation references.

The pedestals are clearly marked, on the outside with 2 lines: “Ground Level” which corresponds to the setting depth provided by the Surveyor and “Finished Grade” which corresponds to the conduit installation height inside the pedestal. To install the pedestal, the site is excavated to the location and depth pre-determined derived from the Surveyor’s offset stakes and elevation nails. 150mm drain rock layer is installed and raked flat. Pedestal is slung in place, using an excavator attached to the lifting rings, (note: pedestal is awkward to handle and top heavy), with all 3 legs on the drain rock base. Pedestal is levelled and temporarily braced.

The Surveyor checks that elevation and orientation is correct and records the information.

200mm sand is installed and raked flat around and under the pedestal usually extending .5m beyond the legs. Sand is wetted and a 200lb plate packer is used to compact the sand and firm up the unit to accept conduit installation.

Conduits enter the pedestal from underneath via a 90-degree conduit bend. Extensions are added, similar to those in a Joint Use pedestal, using the white couplers to extend them to the “Finished Grade” line. Conduits are labelled and left un-capped.

Leave temporary bracing in place till conduits are installed and the unit is partially backfilled. Re-check level, adjust and re-compact as necessary.

Install ground wire as outlined in the “Grounding” section.

To backfill, first install sand around the conduits and place common fill around the pedestal firmly packed with 200lb plate packer, finish off the top lift with the larger trench packing equipment.

Ensure there are no rocks near or in between the conduits.

Ensure no rocks or sand enter the ducts while backfilling.

Ensure pedestal is level and that doors open and close smoothly.

NWTel Alternate Pedestals

There are some types of NWTel pedestals, commonly installed in commercial areas, that perform similar functions to the TV2500/AG-6. These are used because they are a bit larger to accommodate the more extensive cable requirements in commercial areas. These pedestals are supported in place secured by a poured-in-place concrete foundation.

The proper way of starting this type of installation is for the contractor to measure the inside footing dimensions of the pedestal and construct a portable 2x4 wood frame. This frame forms a guide for the conduit installations. Run in the ground wire and leave a 1m loop. Conduit installations are installed on a 90-degree bend and covered, usually with a poly sheet firmly taped in place, to prevent sand or other debris falling into the conduits.

Installation is left this way as other work progresses as is best to complete these types of installations all in one separate operation.

To complete the installation, build up the surrounding area with wetted, compacted sand to a point where the pedestal will sit relative to final elevation.

Install the pedestal sitting on the ground, held in position with the included support legs. There will be 2–4 support legs and bolts included with the pedestal, some pedestals have none, depending on the exact type. Extend conduits as required.

It's normal for the poured-in place base to be 150mm thick.

Final elevation is halfway up the concrete base.

Form the base with wood forms. Usually 500mm from the outside dimensions of the pedestal is sufficient.

NWTel may supply detailed base instructions, and, if so, these instructions will supersede this guide. If in doubt about setting instructions, it's best to consult directly with NWTel Engineering.

In any case, depending on the exact type of pedestal called for in NWTel's plans, they will usually supply field installation instructions.

Pour the base. Let set overnight. Remove forms and blend in the ground to complete the installation.

Note: Tel ducts are in place, note 2x4 duct forming frame, ducts covered with poly awaiting pedestal install. Ground wire in place.

NWTel GLB (ground level box)

These “boxes” come in various sizes, colours and configurations depending on NWTel’s individual application. In general, they are used to break up very long conduit runs where the installation pulling force exceeds the tensile tolerance of the cable. They are also installed as splice points to connect services, or sectionalizing/isolation/switching purposes or the installation of certain equipment deemed necessary for NWTel operations.

The Site Surveyor will provide offset stakes for location, orientation and elevation. Be advised that the GLB’s actual dimensions may vary from the surveyor’s offset dimensions. This is irrelevant as the surveyor will pick up all GLB dimensions and location/elevation information prior to backfill.

They all have certain common attributes:

- Must be installed level on a 300mm bed of drain rock
- Must be internally braced to avoid deformation during backfill/compacting operations. If not done, the lid will not bolt down securely. Metal braces are usually factory supplied but some GLB’s only have slots moulded in where a 2x4 wood brace is firmly wedged into place
- All ducts enter in from underneath terminating in either a 22.5 or 45-degree bend, upturned, to facilitate cable installation procedures and to prevent water ingress
- All ducts are individually capped and identified
- Elevation difference between top of box and final elevation is 200mm, the idea is to prevent water entry by ensuring the box isn’t acting as a sump. Blend in ground contour by hand to complete the installation
- Each box is provided with a #2 bare copper ground conductor, details of which are in the “Grounding” section
- Bolt the lid in place

Be aware that some GLB's may be installed in an area of finished concrete. In this case, it's very important to ensure the setting depth is such that the box does not pose a tripping hazard to pedestrians or become damaged by snow removal operations. The Site Surveyor will have final concrete elevations to guide the installation.

There may be instances where the box is installed on a slope. In this case, a discussion is held on-site with the Site Surveyor, the Shallows Foreman and the Shallows Inspector to determine the best installation approach.

Note: Orange over red configuration, ground wire, internal bracing, ducts capped and identified, lids bolted in place, drain rock foundation, ducts entering from underneath, upturned ducts inside the box.

NWTel may specify markers be installed to prevent damage caused by snowplowing activities. Pound in a galvanized sign post stake and slide marker over top.

SPECIAL CAUTION: if these are not installed at construction phase, a cable locate is required

NWTel FDH 39 Vault

Vault is similar to the GLB with some exceptions. The vault is built out of a poly/concrete material making it very heavy. The GLB can easily be set in place lifted by 2 men, whereas the FDH vault needs to be slung in place using an excavator. There are lifting bolts supplied for this purpose incorporated into the vault's design.

There is an opening in the top cover to permit a cabinet, containing electronic switchgear, to be installed by Communications Techs at a later date.

The vault comes with a series of access holes built into the bottom edge to permit conduit entry points as opposed to the GLB where ducts enter from underneath the box. Ducts enter straight in with no upturned elbow. 100mm protrusion inside the vault is adequate, ensure all ducts are left capped and identified. Ensure all unused conduit entry points are capped.

The FDH vault is installed on a level bed, 300mm thick, consisting of drain rock.

Proper setting elevation is 200mm measured from the bottom of top lip to final elevation.

The surveyor will provide offset stakes showing orientation and elevation.

A #2 bare copper conductor is installed and left coiled at bottom of vault.

Prior to backfill, the surveyor will record the as built information and do an elevation check.

Securely bolt the covers in place and ensure the vault opening is covered with plywood prior to backfill.

NWTel may provide additional installation instructions and may even specify a poured-in-place concrete base be added. In any event, it is important to reference any documentation provided.

If there are any questions or concerns, the Shallows Inspector will consult with NWTel Engineering.

Note ducts entering through factory moulded access holes, unused openings left capped, switchgear cabinet installed.

Riser Poles Tel and Power

As a component of shallow utilities installation, the contractor may be requested to build a riser pole. The pole will be already in place. Specifications for riser pole construction is provided by the electric utility though there may also be 1 or more NWTel conduits sharing the installation.

The Shallows Inspector must be present for any work being done at this installation. The Shallows Inspector will have already notified (and obtained permission from) the electric utility that work is being performed on their system, at this exact location.

For this type of installation, the contractor will excavate to depth exactly where directed by the Shallows Inspector.

The first riser bracket (Unistrut) will be installed on the pole, location of this bracket is critical.

For the electric utility, there will be either 1 or 3x4 inch conduits attached. There may also be a streetlight feed conduit. Conduits must be bolted to the bracket. They will be either a heavy gauge steel elbow or a Rigid PVC elbow as directed by the electric utility drawings. If using a steel elbow, the coupler-to-steel joint must be wrapped with 2 or more layers of stretched Self-Amalgamating Rubber tape. All adaptors, brackets, tape and mounting hardware will be supplied by the utilities.

For NWTel there can be 1 or 2 conduits. NWTel uses 4-inch Rigid PVC elbows and riser conduit.

Installation of the second bracket and installation of the first 3m length of conduit is usually, but not always, done by utility crews. The Shallows Inspector will determine this in consultation with the utilities.

In general terms only, if the electric utility specifies a rigid steel construction then it's best for the General Contractor to install the first length of steel conduit and the second bracket as it makes alignment much easier and leads to a better looking and performing product. If the first length of conduit is installed by the electric utility crew, there can be excessive strain put on the buried DB2-to-steel coupler to achieve proper fitment and alignment.

Using a Rigid PVC elbow and Rigid PVC conduit running up the pole, the effect is reduced, but not eliminated.

Standard DB2 conduit, coming out of the ground and exposed to sunlight is not to be used for either utility. Exposed DB2 conduit on a riser pole is a deficiency.

The ends of the conduits must be properly identified and sealed with plastic bags to prevent debris, rain, snow or critters from entering the ducts.

The installation must be grounded, as directed by electric utility specifications.

The General Contractor will install a ground rod, at minimum, and leave the end exposed for electric utility crews to attach grounding wire. Depending on circumstances, the Shallows Inspector may direct the ground wire be connected to the conduits and a tail left to go up the pole. This will be decided between the Shallows Inspector and the electric utility.

Note: This is a finished installation with 3 steel electric utility ducts and a single DB2 NWTel duct. Be advised that NWTel has since upgraded its standard to Rigid PVC only.

Grounding

Grounding specifications are provided by the electric utility. There shall be no deviations to these specifications without the express consent of the electric utility.

Definitions for purposes of this guide:

Grounded means that there is a direct electrical connection made between a piece of equipment and an installed ground rod.

Bonded means that various pieces of equipment at a "site" are electrically connected to each other and to ground.

Ground Grid is referred to as a series of ground rods (usually, but not limited to, 4 rods) placed a certain distance outside of each corner of a transformer or electrical switchgear installation, connected together with 2/0 bare copper conductor.

For the shallow utility installation contractor, it is sufficient to know that proper grounding and bonding techniques are essential to efficient equipment operation and to protect utility workers and members of the public from inadvertent electric shock.

It is paramount that any electrical connections, made by the contractor, be clean and tight to keep resistance to current flow as low as possible. Clean any sand, mud or corrosion from all connection surfaces using a wire brush.

The Shallows Inspector can answer any questions in this regard.

Every piece of electric or communication equipment installed in a subdivision is provided with copper wire connected to a ground source. The connection(s) to the equipment is made by utility crews.

Ground conductors are not to be placed under conduits.

All grounding and bonding connections, inside a subdivision, made by the shallow utilities installation contractor, are made with Ampact connectors installed using a special explosive actuated tool.

Use of the tool requires training and the use of eye protection and work gloves (minimum PPE) is mandatory.

Ampact connectors are colour coded to the explosive “shell” used to actuate the tool.

Bare copper conductors size #2 or 2/0 are used exclusively. The grounding specs provided by the electric utility dictate which size to use depending on the application.

Ampact connectors are sized as follows depending on application:

- #2 to ground rod
- #2/0 to ground rod
- #2/0 to 2/0
- #2 to 2/0

When connecting to a ground rod, do not connect to the tapered portion of the rod.

Ground conductors, ground rods and ground rod couplers, and all other connectors are provided by the electric utility.

The General Contractor is responsible to provide the installation tool.

The tool should be kept clean and dry and be dismantled and serviced from time to time. A servicing tool is provided by the manufacturer for this purpose.

It is common practise for the General Contractor to assign grounding and bonding applications, as well as tool safe keeping and maintenance, to one trained individual.

The explosive shell actuators should be kept in a safe, dry and clean environment.

Grounding and bonding operations are usually carried out in the presence of the Shallows Inspector.

Only the Shallows Inspector can approve backfill of a grounding installation.

A Note on Communications Utility Grounding

All AG-6 service pedestals and any other types of pedestals at a "site" shall be provided with a #2 copper tail bonded to the utility ground grid. If outside of a 3m distance to the utility grid, the installation shall be considered as stand-alone and provided with a separate ground rod and #2 copper conductor.

There shall be no communications conduits passing through an electric utility ground grid.

GLB's and FDH vaults shall be provided with a #2 ground wire. If inside 3m to the utility ground grid, a bonding wire is sufficient. If outside the 3m distance, install a ground rod inside the vault and leave a 1.5-meter tail coiled up.

NWTel, on certain applications, may specify different grounding requirements than mentioned above. In these cases, NWTel will either communicate this directly to the Shallows Inspector or have a special mention in their "construction package".

Note:

1. *Site is identified*
2. *Vault top and unused "mouseholes" are covered*
3. *All streetlight conduits taped up*
4. *Streetlight base and TV2500 pedestal bonded to the 4 point electric utility ground grid*
5. *Backfill done with wetted, compacted sand*
6. *Conduits pass under ground conductors*
7. *Orange paint indicates surveyor has picked up as built information, site ready for backfill*

Note:

1. *TV2500 pedestal is bonded to 4-point electric utility ground grid*
2. *"Mouseholes" in switch vault covered*
3. *Conduits pass under ground conductors*
4. *Site identified*

Note: NWTel stand-alone TV2500 ped application showing grounding detail.

Note:

1. *Joint use pedestal and streetlight base share a common ground rod*
2. *Orange paint indicates site is ready for backfill*
3. *Of special note here is that red conduits (service stubs) pass over orange communications conduits. This is done to prevent a 3-pipe crossover. This condition is referred to in the "Conduits" section.*

Note: NWTel GLB with its own ground rod and ground conductor.

Note: Both photos show communications conduits do not pass through the ground grid.

Field Enhancements

During construction, often a minor change can add considerable benefit. Such a change may not be readily apparent to the utility designer(s) but becomes apparent relative to actual site conditions or when the electric and communications plans are combined in the field.

Examples of a field enhancement:

- Modern subdivision lots tend to be much smaller than in the past. Utility infrastructure placed in front of a lot poses encumbrance. Single-phase transformers are placed straddling the lot line. This site is usually accompanied by a streetlight and a AG-6 pedestal. The utility plans show where the equipment is to be installed but sometimes a site plan may show the AG-6 pedestal and a streetlight placed on the same side of the transformer. This encumbers the front of one lot with two and a half pieces of equipment and the adjacent lot with one half piece of equipment. The site is “enhanced” by putting one piece of equipment on each side of the transformer.

- It can happen where the electric utility and the communications utility have to install single pieces of equipment on a stand-alone basis. This can lead to a condition where the survey layout calls for 2 pieces of equipment to encumber a single lot frontage. The site can be “enhanced” by relocating one or both pieces. This type of deviation is usually referred to the respective utilities for input/approval.

- 90-degree main line conduit bends are “enhanced” by using 2x45-degree bends, 2 meters apart to shallow up the bend. This goes a long way to reduce cable pulling tension. Depending on circumstances, 4x22.5-degree bends may be used with an appropriate length of straight conduit in between.

- Shallow curves on main line conduit runs are “enhanced” by bending the conduit instead of using preformed bends. This is referred to in the “Conduit” section.

- Separate conduit trenches can often be amalgamated into one. Sometimes a streetlight feed can be rerouted to eliminate a separate trench.

- Road crossings can sometimes be rerouted to both shallow up a long pull or to avoid crossing a storm pipe, which eliminates need for concrete cover. Sometimes a minor trench deviation can be done to increase clearance to a manhole or catch basin.

- A lot service can be missed on the plans.

- It can happen, on a commercial lot service, that electric and communications services come from 2 separate sites. Since both services end up connecting to the building at the same point the service to the lot may be "enhanced" by combining both services to come from one site.

- When servicing a lot with very small frontage, ensure that the service stubs stay as far away as possible from the water and sanitary service stubs.

- A sloped site may lead to a piece of equipment installed in a depression acting as a sump. The ground should be contoured first to mitigate this condition. This likely leads to a new survey layout as setting elevation has changed.

There can be other site conditions to take into consideration as well. Often the need for a field enhancement comes from the survey layout. This layout is an interpretation derived directly from utility plans.

For example: if a utility plan shows the conduit run under the curb as opposed to under the sidewalk, where it should be, the layout will show under the curb.

Also, the survey layout may call for separate, adjacent trenches, sometimes they can be combined. This situation is a result of "interpretation" by the survey company.

The Surveyor will not, and cannot, layout what he (she) sees as a deviation, but will certainly pick up the deviation on the "as built" plans. If layout survey is required to accommodate a deviation, this must be pre-approved by the Engineer's Inspector who will authorize the Surveyor accordingly.

- **A Field Enhancement does not change utility design parameters as far as "which box feeds which". Such a change requires utility engineering approval.**

- **In all cases, only the Shallows Inspector or a utility representative can initiate and authorize a Field Enhancement.**

- **In all cases, a Field Enhancement requires approval from the Engineer's Inspector and some may also require approval from utility engineering.**

All field enhancements are to be documented, signed off and dated on the plans marked "as built" by the Shallows Inspector.

Locates

Electric and communications utilities have a procedure in place for contractors or individuals wishing to do excavation work or wishing to install fence posts or other structures near buried utilities.

The process begins with the parties doing the work to request a formal Cable Locate.

For the General Contractor, this process applies when having to do deep utility or surface works tie-ins, conflicting with existing utility infrastructure, on the edges of the active construction site.

As the Contractor's Site Superintendent, the Engineer's Inspector and the Shallows Inspector are in close daily communication, it's normal that the Shallows Inspector would make the locate request to the electric and communications utilities.

The electric utilities will electronically locate their cables and mark the ground surface with RED paint, the communications utility will mark the ground with **ORANGE** paint.

The requesting party is provided documentation that permits them to work up to 1 meter away from the paint marks. Any ground disturbance done within the 1 meter "Danger Zone" will be done under the direct supervision and control of the utilities. This is clearly stated in Yukon OH&S Regulations and in the Alberta Electric and Communication Utility Code.

Exposing and supporting conduits, if necessary, will be done using HydroVac techniques (outside contractor) and will be done under direct utility supervision. The utilities may or may not assign supervision responsibilities to the Shallows Inspector.

Any costs attributable to this effort will be assigned to the General Contractor or to the Owner (YG) at the discretion of the Engineer's Inspector.

Inside the subdivision, which is considered an active construction site, the General Contractor, sub-contractors or the survey company assigned to do property pin posting, will need to perform work in close proximity to the newly installed conduit system. This work could involve having to excavate under conduits to do a deep utility tie-in, install street and traffic control signs, install guide pins for the curb machine, install concrete form pins for sidewalk construction and install property pins, shallow lift compaction checking, bollard and/or fence installations or having to do deficiency correction on the deep utility system.

Power and communications conduits, **inside the construction zone limits**, are usually (but not always!) empty or may contain pulling strings.

In this case the Contractor's Site Superintendent approaches the Shallows Inspector to discuss the work involved. The Shallows Inspector will have detailed work drawings and photos and will work with the Site Surveyor, who has electronic "as built" information to provide accurate locates.

Locates provided by the Shallows Inspector will be marked with yellow paint.

Electric and communication utility crews may start the cabling process while the construction site is still active.

In this case, the responsibility to provide locates may or may not be assigned by the utilities to the Shallows Inspector.

Regardless, the Shallows Inspector will ensure that all parties on site are kept informed of cabling operations and will be in constant contact with the utilities to provide updates.

The guiding principles are:

- **Empty conduits, within an active construction site, will be located by the Shallows Inspector.**
- **Conduits containing any power or communications cables (regardless of where they are) fall under jurisdiction of the utility owning the cables; therefore, providing locates and special instructions is their responsibility.**

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