

CONTRACT DOCUMENTS

Town of Outlook Raw Water Pump House Upgrades

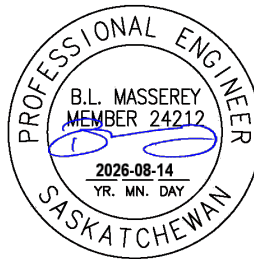


August 2026

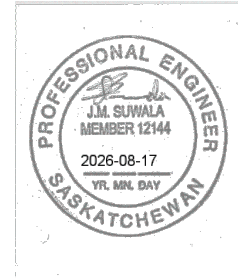
CONTRACT SPECIFICATIONS
FOR
TOWN OF OUTLOOK
RAW WATER PUMP HOUSE UPGRADES



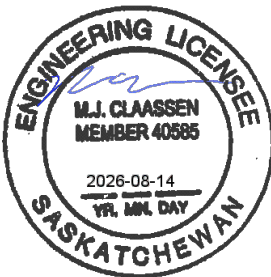
Civil



Electrical



I&C



Mechanical



Process



Structural

ASSOCIATION OF PROFESSIONAL ENGINEERS AND GEOSCIENTISTS OF SASKATCHEWAN CERTIFICATE OF AUTHORIZATION ASSOCIATED ENGINEERING (SASK.) LTD. NUMBER C116 Permission to Consult Held By:		
Discipline	Sask. Reg. No.	Signature
Bldg. Mech.	44157	
Civil	35677	
EI&C	22943	
Process	13363	
Structural	20379	

Associated Engineering (Sask.) Ltd.
ISSUED

Signature:

Prepared by Associated Engineering (Sask.) Ltd.

These Contract Documents are for the sole use of the Engineer, and of the Owner, Contractor, Subcontractors, and Suppliers having a contract for the execution of the Works covered in the Contract Documents, in whole or in part. The Contract Documents contain proprietary and confidential information that shall not be reproduced in any manner or disclosed to or discussed with any other parties without the express written permission of the Engineer. Information in these documents is to be considered the intellectual property of the Engineer in accordance with Canadian copyright law.

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END OF SECTION

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GENERAL

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4675-02-C-102 Plan, Raw Water Pump House Site

STRUCTURAL

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4675-02-S-101 Plans

4675-02-S-501 Details

4675-02-G-502 Details, Steel

PROCESS

4675-02-D-001 Legend and P&ID

4675-02-D-101 Plans, Demolition and Proposed

4675-02-D-301 Sections

4675-02-D-501 Details

ELECTRICAL

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4675-02-E-002 Legend

4675-02-ED-101 Power and Lighting, Demolition

4675-02-ED-901 Elevation and Photos, Demolition

4675-02-E-101 Plans and Demolition, Power and Lighting

4675-02-E-601 Lighting and Panel Schedule, Pump Control Schematic

INSTRUMENTATION

4675-02-EI-001 Network Diagram, Bill of Material and Detail

4675-02-EI-501 Power Distribution

4675-02-EI-502 P&ID

4675-02-EI-503 Detail, Level Transducer Installation

END OF SECTION

Sealed bids marked "Town of Outlook Raw Water Pump House Upgrades" project will be received through the bids&tenders® online platform (<https://ae-sk.bidsandtenders.ca/>) **up to 2:00 p.m. local time on September 10, 2026**. Bids submitted after the online bidding system closing time will not be accepted by the online bidding system. The time as indicated by the declining time clock on the online bidding system shall be the official time for closing.

The Work involves the following:

- Civil, Structural, Mechanical, Electrical, Instrumentation and Controls upgrades at the Town of Outlook Raw Water Pumphouse.

Contract Documents will be available on the bids&tenders® online platform (<https://ae-sk.bidsandtenders.ca/>) on or after **August 18, 2026**. Bidders are required to check for any updated information and addenda issued before the closing date and time at the bids&tenders® online platform (<https://ae-sk.bidsandtenders.ca/>).

Any changes to the bid documentation will be issued by means of written addenda and posted to the online bidding website and will form part of the bid. No amendment of any kind to the tenderer is effective unless it is posted in a formal written addendum. Upon submitting to this Bid, Bidders will be deemed to have received Notice of all addenda that have been posted and deemed to have considered the information for inclusion in the tender submitted.

Technical inquiries by bidders are to be directed to Andrew Bueckert at 306-808-3103 or via email at bueckerta@ae.ca.

A bidders' briefing is scheduled for August 26, 2026 at 2:00 p.m. Meeting to commence at the Town office located at 400 Saskatchewan Avenue West Outlook, SK S0L 2N0. It is in the best interest of the bidder to attend this briefing.

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

The lowest or any bid will not necessarily be accepted.

Contact for the Owner:

Town of Outlook
400 Saskatchewan Avenue West
Outlook, SK S0L 2N0
Phone: 306-867-8663
Email: cao.outlook@sasktel.net
Attn: Kevin Trew, CAO

Contact for the Engineer:

Associated Engineering (Sask.) Ltd.
203 Wellman Avenue
Saskatoon, SK S7T 0J1
Phone: 306-808-3103
Email: bueckerta@ae.ca
Attn: Andrew Bueckert

END OF SECTION

Part 1 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 Document.

.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 Bids will be received through the bids&tenders® online platform (<https://ae-sk.bidsandtenders.ca/>) up to 2:00 p.m. on September 10, 2026. The time as indicated by the declining time clock on the Online Bidding System shall be the official time for closing. Bids submitted after the Online Bidding System closing time will not be accepted by the Online Bidding System. Unverified Bid results will be posted publicly on the online bidding site within 1-hour of the closing time.

- .2 Offers will be opened privately shortly after the Bid Closing Time.

1.4 INTENT

- .1 The intent of this bid process is to obtain an offer to complete the necessary upgrades at the Town of Outlook's Raw Water Pump Station to prolong the lifespan of the facility for 10-15-years for a Lump Sum Price contract, in accordance with the Contract Documents. Refer to Division 01 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 will be available from bids&tenders® online platform (<https://ae-sk.bidsandtenders.ca/>) on or after August 18, 2026.
 - .2 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.
 - .3 Refer to Section 00 30 00 - Information Available to Bidders for identification of information available to Bidders.
- .2 Examination:
 - .1 Upon receipt of Bid Documents, verify that documents are complete. Notify Engineer should the documents be incomplete.
 - .2 Immediately notify Engineer upon finding discrepancies or omissions in Bid Documents.
- .3 Queries/Addenda:
 - .1 Direct questions to Andrew Beuckert, telephone 306-808-3103, email bueckerta@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 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.
- .4 Proposed substitutions:
 - .1 Base Total Bid on use of specified products. No substitutions will be considered during the Bid period.

1.6 SITE ASSESSMENT

- .1 Site examination:
 - .1 Visit the Project Site and surrounding area before submitting a bid.
- .2 Bidders briefing:
 - .1 A briefing for Bidders has been scheduled for August 26, 2026 at 2:00 p.m. Meeting will begin at the Town Office located at 400 Saskatchewan Avenue West Outlook, SK S0L 2N0.
 - .2 All general contract and major subtrade Bidders and Suppliers are invited.
 - .3 Representatives of Owner and Engineer will be in attendance.
 - .4 Material changes to the Bid Documents arising from the briefing will be recorded in an Addendum and issued to known Bidders.
 - .5 Due to the nature of the facility, access to the Town of Outlook Raw Water Pump house portion will be limited to viewing from the outside.

1.7 QUALIFICATIONS

- .1 Bidder's qualifications:
 - .1 Submit completed Section 00 45 13 - Bidders' Qualification form with the Bid Form.
- .2 Subcontractors:
 - .1 Indicate on Section 00 43 36 - Proposed Subcontractors Form in the Supplements to Bid Form the names of all Subcontractors proposed to be employed on the Work.
 - .2 Owner reserves the right to object to any of the Subcontractors listed in Section 00 43 36 - Proposed Subcontractors Form and such objection may be valid cause for rejection of the bid. If Owner objects to a listed Subcontractor, then Owner will permit Bidder, within 5 days of such Notice, to propose a substitute subcontractor acceptable to Owner provided that there is no resulting adjustment in the Total Bid or the Contract Time. Bidder is not required to make such a substitution and, if Owner objects to a listed subcontractor, rather than propose a substitute subcontractor, Bidder may by Notice request that Owner rejects its bid and Owner will agree to that request. In that event, Owner shall return that Bidder's Bid Deposit.

1.8 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, Supplements to Bid Form, Bid Bond, Bid Deposit, 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 may be declared informal. If so declared, the bid will be rejected.
- .2 Submissions:
 - .1 Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.
 - .2 Bids received by fax or email shall be rejected.
 - .3 For electronic submissions, it is recommended Bidders call Engineer to confirm Engineer's receipt of the Bid, prior to Bid Closing.
- .3 Bid modifications:
 - .1 Amendments to the submitted offer shall be permitted according to the conditions of the Bids and Tenders Online Bidding System. Amendments received by fax, email or in person shall be rejected.
 - .2 The onus is on Bidder to ensure timely receipt of bid modifications through the Bids and Tenders Online Bidding System. Until Bid closing the Bidder may remove, revise and resubmit a previously submitted bid. The Bidder is under no obligation to submit a bid if their intention is to withdraw their submission.
 - .3 Amendments received by fax, email or in person shall be rejected.
- .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.

1.9 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 Section 00 43 24.
 - .4 If no contract is awarded, all Bid Deposits will be returned.
 - .5 If the accepted Bidder fails for any reason to execute Document 00 52 00 - Contract Agreement or to provide the surety bonds stipulated in Document 00 72 00 - General Conditions or the insurance stipulated in Document 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 by forfeit of the Bid Deposit or a portion thereof 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 the 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 prices where indicated on Bid Form.
 - .2 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 and PST payable by Owner.
 - .3 The amount of GST and PST 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.
 - .4 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 Section 00 43 14 - Consent of Surety.
 - .2 Section 00 43 24 - Bid Bond.
 - .3 Section 00 43 36 - Proposed Subcontractors Form. List the names of all Subcontractors. Identify portion(s) of the Work to be performed by each subcontractor.
 - .4 Section 00 45 13 - Bidder's Qualifications. Complete in all details and submit with the Bid Form.
- .10 Supplements to Bid Form for post-bid submission:
 - .1 Following bid submission, upon request from Engineer, Bidders under consideration for contract award are required to complete the following Supplements to Bid Form within 2 Business Days of receipt of the request:
 - .1 Section 00 43 27 - Lump Sum Price Breakdown. Provide an accurate and balanced breakdown of lump sum price(s) to be used for calculating progress payments and for cost accounting purposes.
 - .2 Section 00 43 83 - Construction Schedule. Provide the requested schedule information to demonstrate ability to plan Work and respond to critical deadlines.

1.10 OFFER ACCEPTANCE/REJECTION

- .1 Duration of offer:
 - .1 Bids shall remain open to acceptance and shall be irrevocable for a period of 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 Acceptance of an offer will be made on Bidders that will give the greatest value based on quality, service and price.
 - .3 The Owner reserves the right to, prior to acceptance of any offer, negotiate with the Bidder that represents the lowest compliant offer in terms of value based on the terms of these Instructions to Bidders and the Contract Documents. The Owner has no duty or obligation to advise any other Bidder of such negotiation or to allow them to vary their Bid Price due to any negotiations with the lowest compliant Bidder.
 - .4 After acceptance of an offer by Owner or 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 Receipt of Permit to Construct from the Water Security Agency.
- .3 Approval to award contract from the Mayor and Council from the Town of Outlook.
- .2 These conditions will not 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 PHOTOS OF EXISTING FACILITIES

- .1 Photographs of the existing facilities may be available to prospective bidders upon request to the Engineer. Any such photographs provided are intended for general reference only.
- .2 The Owner and the Engineer make no representation or warranty, express or implied, as to the accuracy, completeness, or current condition depicted in the photographs. The photographs may not reflect all site conditions or recent changes.
- .3 Bidders are solely responsible for satisfying themselves as to the nature and extent of the existing facilities and site conditions, including through review of the Contract Documents and any site visits deemed necessary. The Owner and Engineer shall not be liable for any interpretations, conclusions, or decisions made by the Bidder based on the provided photographs.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF DOCUMENT

Town of Outlook
Raw Water Pump House Upgrades

TO: Kevin Trew, CAO
Town of Outlook
400 Saskatchewan Avenue West
Outlook, SK S0L 2N0

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 sum of:

Lump Sum Price:	² \$ _____
Cash Allowance:	\$35,000 _____
TOTAL BID (excluding GST PST):	² \$ _____
Goods and Services Tax:	² \$ _____
Provincial Sales Tax:	² \$ _____

¹ Bidder to fill in each Addendum No. received, e.g., 1, 2, 3, etc. as applicable.

² To be completed by Bidder.

The undersigned also agrees:

1. that Owner is in no way obligated to accept this bid;
2. that Owner may, at Owner's discretion, award to other than the low Bidder;
3. that, if the Bid Form is improperly completed or incomplete, Owner shall have the right to disqualify and/or reject this bid;
4. that this bid is made without knowledge of the bid prices to be submitted for this Work by any other company, firm, or Person;
5. that this bid is made without any connection or arrangement with any other company, firm, or Person submitting a bid for this Work;
6. 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;
7. that this bid is irrevocable for 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;
8. 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;
9. 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 a period of _____ calendar days from Notice of Award, subject to the provisions of the General Conditions for extension of Contract Time;
10. to compensate Owner in accordance with the Contract Documents if the Work is not completed within the Contract Time;
11. 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;
12. 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;
13. 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 and PST payable by Owner; and
14. 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 and PST payable by Owner.

**UNIT PRICES FOR ITEMS ADDED TO AND
DELETED FROM LUMP SUM PRICE WORK**

The following unit prices shall apply to approved additions to or deductions from the lump sum price items in the Contract. These unit prices include all applicable provincial taxes and customs duty, and charges for the Contractor's overhead and profit, but exclude GST and PST payable by the Owner.

Item	Description	Unit Prices		
		Units of Measure	Additions	Deletions
1	Delete the requirement to furnish the necessary labour, materials and equipment to undertake the replacement of the pump starters for the Town of Outlook RWPH pumps. Existing pump starters and associated controls to remain.	LS		
2	Delete the requirement to furnish the necessary labour, materials and equipment to undertake the replacement of the Control Panel (ACP-970) and associated programming for the Town of Outlook Raw Water Pumphouse. LIT-100 and TIT-201 to also be removed from the scope of work. Existing level transmitter and pump startup valve controls to be re-used and re-integrated with new pump startup valve.	LS		
3	Delete the requirement to furnish the necessary labour, materials and equipment to undertake the installation of the electric unit heater (EUH-1) and the intake damper (ID-1) and louvre (L-1) from the Town of Outlook Raw Water Pumphouse.	LS		

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.

Section 00 43 14 - Consent of Surety Company
Section 00 43 24 - Bid Bond
Section 00 43 36 - Proposed Subcontract Form
Section 00 45 13 - Bidder's Qualifications

The following Supplements to Bid Form are not being submitted with our bid. These forms will be completed and submitted upon request. We understand that the information provided on these forms may be used by the Owner during bid analysis.

Section 00 43 27 - Lump Sum Price Breakdown
Section 00 43 83 - Construction Schedule
Section 00 61 13.13 - Performance Bond
Section 00 61 13.16 - Labour and Material Payment Bond
Section 00 62 16 - Certificate of Insurance

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

Occupation

Seal

For Limited Company or Corporation:

The Corporate Seal of:

Bidder (please print)
was hereunto affixed in the presence of:

Authorized Signing Officer
Title

Seal

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 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 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 found on the Canadian Construction Documents Committee (CCDC)
website: <https://www.ccdc.org/document/ccdc-220-221-222-2024-bond-forms/>

Supplement to Bid Form

We certify that the following is an accurate and balanced breakdown of our lump sum price(s). Work required, but not specifically mentioned, is included in the item with which it is most closely associated.

Item	Description	Lump Sum Price
1	Outlook Raw Water Pumphouse Upgrades	
1.1	General Requirements	\$
1.2	Civil Site Works	\$
1.3	Structural and Architectural Works	\$
1.4	Mechanical Upgrades	\$
1.5	Electrical, Instrumentation and Controls Work	\$
1.6	Golf Course Pump Supply, Installation and Removal	\$
1.7	Temporary Pumping, Including Monitoring	\$
Total (sum of items 1.1 through 1.7)		\$

END OF DOCUMENT

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	Name and Address of Subcontractor

END OF DOCUMENT

Supplement to Bid Form

We provide the following information relative to the Construction Schedule in order that Owner may assess our ability to plan the Work and respond to critical deadlines.

Item	Schedule						

We provide the following information relative to the Construction Schedule in order that Owner may assess our ability to plan the Work and respond to critical deadlines. Provide Construction Schedule in the form of a Gantt Chart.

END OF DOCUMENT

Supplement to Bid Form

We provide the following information in order that Owner may judge our ability to fulfil the Contract requirements.

1. The average number of workers we will employ and maintain on the project is _____.
2. The name of the Superintendent we propose to place on the project and their previous experience on this type of construction is as follows:

Superintendent Name:			
Project Name and Value (\$)	Owner	Contact Name	Phone Number

3. The project, owner and contact person for similar work:

Project Name and Value (\$)	Owner	Contact Name	Phone Number

END OF DOCUMENT

NOTICE OF AWARD (a copy of the Notice of Award will be placed in this section).

THIS AGREEMENT made this ____ day of _____ in the year 20__ by and between Town of Outlook, 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 "Town of Outlook Raw Water Pump House Upgrades" which have been prepared by Associated Engineering (Sask.) 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 within a period of ____ calendar days, 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, Supplements to 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:
E-mail:
Owner at: Town of Outlook
Address: 400 Saskatchewan Avenue West Outlook, SK S0L 2N0
E-mail: cao.outlook@sasktel.net
Engineer at: Associated Engineering (Sask.) Ltd.
Address: 203 Wellman Avenue Saskatoon, SK S7T 0J1
E-mail: bueckerta@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 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.

For Individual or Partnership:

SIGNED, SEALED AND DELIVERED by:

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

For Limited Company:

The Corporate Seal of:

_____	Contractor (please print)		
was hereunto affixed in the presence of:			
_____	Authorized Signing Officer	_____	Title
			Seal
_____	Authorized Signing Officer	_____	Title

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.

For Corporate Owner:

The Corporate Seal of:

Owner (please print full corporate name)

was hereunto affixed in the presence of:

Authorized Signing Officer Title

Seal

Authorized Signing Officer Title

For Individual Owner:

Owner (please print)

Signature

Signature of Witness

Address of Witness

Occupation

END OF DOCUMENT

Supplement to Bid Form

Use CCDC standard form 221 found on the Canadian Construction Documents Committee (CCDC)
website: <https://www.ccdc.org/document/ccdc-220-221-222-2024-bond-forms/>.

Supplement to Bid Form

Use CCDC standard form 222 found on the Canadian Construction Documents Committee (CCDC) website: <https://www.ccdc.org/document/ccdc-220-221-222-2024-bond-forms/>.

Use standard 2-sided form, which follows.

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
EMPLOYERS LIABILITY		WRAP UP ☐	\$ INCLUSIVE
			\$ AGGREGATE PRODUCTS
AUTOMOBILE LIABILITY OWNED/LEASED VEHICLES		EFFECTIVE	\$ EACH PERSON
		EXPIRY	\$ EACH ACCIDENT
AUTOMOBILE LIABILITY NON-OWNED VEHICLES			BODILY INJURY
			\$ EACH PERSON
			\$ EACH ACCIDENT
			PROPERTY DAMAGE
			\$ EACH ACCIDENT
UMBRELLA LIABILITY			BODILY INJURY & PROPERTY DAMAGE
			\$ INCLUSIVE
BUILDERS RISK/ INSTALLATION FLOATER		EFFECTIVE	\$ LIMITS
		EXPIRY	EXCESS OF \$
			\$ SITE
			\$ OTHER LOCATION
		WRAP UP ☐	\$ TRANSIT
CONTRACTORS		EFFECTIVE	\$
EQUIPMENT WORKERS' COMPENSATION OTHER		EXPIRY	
		EFFECTIVE	AS REQUIRED BY THE ORDINANCE(S)
		EXPIRY	OF THE

PARTICULARS OF INSURANCE	
GENERAL LIABILITY	BUILDERS RISK/INSTALLATION FLOATER
☐ Premises Property and Operations ☐ Products and Completed Operations ☐ Blanket Contractual (all written agreements) ☐ Tenants Fire Legal Liability ☐ Owners and Contractors Protective ☐ Occurrence Bodily Injury and Property Damage ☐ Broad Form Property Damage ☐ Contingent Employers Liability ☐ Personal Injury ☐ Sudden and Accidental Pollution Liability ☐ Non-Owned Automobile Liability ☐ Severability of Interest or Cross Liability ☐ 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 ☐ ☐ ☐	☐ All Risk Form ☐ Fire, Extended Coverages, Riot, Vandalism or Malicious Acts ☐ Difference in Conditions ☐ Flood Included ☐ Earthquake Included ☐ Excludes Faulty Workmanship, Faulty Construction or Faulty Design but not loss resulting therefrom ☐ Covers Transit by Land ☐ Covers Boiler Explosion during Installation, Temporary Operation and Testing ☐ Covers Owner as Additional Named Insured ☐ Grants Permission for Occupancy prior to completion ☐ Waiver of Subrogation Against Additional Insureds ☐ 30 Days Notice of Cancellation ☐ ☐ ☐ ☐ ☐ ☐
CONTINGENT EMPLOYERS LIABILITY ☐ 30 Days Notice of Cancellation ☐	CONTRACTORS EQUIPMENT ☐ Subrogation Waived Against Owner ☐ Subrogation Waived Against Owner, Construction or Project Manager, Architects and Engineers ☐ 30 Days Notice of Cancellation ☐ ☐
AUTOMOBILE ☐ 15 Days Notice of Cancellation ☐	NON-OWNED AUTOMOBILE ☐ 15 Days Notice of Cancellation ☐
MARINE/AIRCRAFT ☐ 30 Days Notice of Cancellation	OTHERS ☐ ☐ ☐ ☐
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

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PART 1 CONTRACT DOCUMENTS

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 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 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 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.

“Lien Fund Holdback” means the total of lien holdbacks from progress payments for Work performed that is withheld from the Contractor in accordance with the Lien Act.

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

“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.

“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.

“Payment Legislation” means such legislation in effect at the Project Site which governs payment under construction contracts.

“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 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 performed during the Warranty Period 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.

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.

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.

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 2 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.

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.

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.

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.

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 INSURANCE, WORKERS' COMPENSATION AND BONDS

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.

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. At a 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.

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 Work 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 GENERAL PROVISIONS

GC 12. EXECUTION OF THE CONTRACT AGREEMENT

- .1 The Contractor shall deliver the following documents to the Engineer within 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) a 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 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 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 15 Business Days after receiving them and the Engineer shall deliver the Contractor's copies to the Contractor.
- .5 The Contractor shall not perform any Work until the requirements of GC12.1 are satisfied.

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.

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 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 themselves with respect to the local conditions to be encountered and the Quantities, quality, and practicability of the Work and of their 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 ADMINISTRATION OF THE CONTRACT

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.

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 during 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 1 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.
- .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 Construction Memos 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 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.

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 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 2 copies of any certificates and inspection reports relating to the Work, or any portion thereof.
- .6 Within 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.

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 The Engineer may withhold from amounts due to the Contractor amounts on account of Deficiencies in accordance with GC 44 WITHHOLDING OF PAYMENT AND SET OFF.
- .4 The Contractor is obligated to remedy, correct and rectify Deficiencies at its own cost and expense. The Contractor is not entitled to any payment under the Contract for any deficient Work or Materials that are incorporated into any Deficiency or that are otherwise in breach of the Contractor's obligations under this Contract. If the Owner or Engineer incur additional costs and expenses as a result of the Deficiencies including the Contractor's repairs or corrections of Deficiencies, the Contractor is liable to the Owner for such amounts and they may be withheld pursuant to GC 44 WITHHOLDING OF PAYMENT AND SET OFF.
- .5 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 Engineer 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.
- .6 In the event that the Contractor does not remedy, correct or rectify the Deficiencies as required herein, the Owner may, upon expiry of 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 EXECUTION OF THE WORK

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.

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 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.
- .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.

GC 21. LAYOUT OF THE WORK

- .1 Unless stipulated otherwise in the Contract, the Engineer shall establish or define reference points for construction which are necessary for the Contractor to proceed with the Work.
- .2 The Contractor shall verify, preserve and protect the defined or 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 all reference points and of the proposed location of the elements of the Work as indicated by the layout, prior to their construction.

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.

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 10 Business Days' Notice of suspension or delayed commencement. The Contractor shall resume Work upon Notice from the Owner within 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 including indirect costs.
- .3 If the delay or suspension of the Work lasts more than 45 Business Days, the Contractor may, at its option and on 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.

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 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.

GC 25. CONSTRUCTION SCHEDULE

.1 The Contractor shall:

- (a) within 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
 - (iii) any other details required by the terms of the Contract, including, without limitation, allowances for weather and inclusion of “float” time allowances, proposed production rates for work items, and proposed shift time to complete the Work in hours or days.
- (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.
- (c) the Contractor’s Construction Schedule shall be delivered electronically to the Engineer in one of the following native formats:
 - (i) Microsoft Projects;
 - (ii) Primavera; or
 - (iii) such other format as is stipulated in this Contract or accepted by the Engineer.

.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.

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. 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 Contractor shall at all times comply with the provisions of all Law related to safety including the OH&S Legislation. The Contractor shall at all times ensure that all subcontractors at the Site shall comply with the requirements of all Law related to safety including the OH&S Legislation. The Contractor shall bring to the attention of all subcontractors the provisions of the OH&S Legislation.
- .3 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.
- .4 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.
- .5 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.

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.

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;
 - (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;
 - (iii) provisions similar to GC9. INSURANCE and Section 00 73 16 – Insurance that require the Subcontractors to obtain and continuously carry insurance with the same limits as the Contractor's insurance; and
 - (iv) any provisions required by the Payment Legislation.

- .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.

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.

GC 30. DOCUMENTS AT THE SITE

- .1 The Contractor shall keep at least 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.

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 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.

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 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 PROTECTION OF PERSONS AND PROPERTY AND TOXIC OR HAZARDOUS SUBSTANCES

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;
 - (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.

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 PAYMENT AND ALLOWANCES

GC 35. GENERAL PROVISIONS RELATING TO PAYMENT

- .1 Payments shall be made to the Contractor in accordance with this PART 7 PAYMENT AND ALLOWANCES, the Supplementary Conditions, the Payment Legislation 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.

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.

GC 37. PROGRESS PAYMENTS

- .1 Applications for payment on account of the Contract shall be submitted by the Contractor to the Engineer and the Owner in accordance with the Supplementary Conditions.
- .2 The Engineer shall be responsible for preparing and issuing to the Owner a Payment Certificate for the period ending the last calendar day of the month.
- .3 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.
- .4 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.
- .5 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 20 Business Days, or such other period as set out in the Supplementary Conditions, after receipt by the Owner of the Payment Certificate as issued by the Engineer.
- .6 All Payment Certificates issued by the Engineer shall be to the best of the Engineer's knowledge, information, and belief.
- .7 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.

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, if required by the Lien Act, such amounts will include 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.
- .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.

GC 39. QUANTITIES

- .1 The estimate of Quantities shown in the 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 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.

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) the Contractor's application for a Certificate of Substantial Performance shall constitute a waiver and release by the Contractor of any and all claims arising out of or relating to the Contract to the date of Substantial Performance. This waiver shall include without limitation those claims that might arise from the negligence or breach of contract by the Owner, the Engineer, and their respective employees, agents, officers, directors, and consultants, but does not include any claims made by the Contractor in writing prior to such application in accordance with the provisions of the Contract Documents and delivered to the Engineer prior to the date of Substantial Performance and still unsettled.
- .3 The Engineer will, no later than 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.

GC 41. RELEASE OF 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, Warranty Work or filed liens or as otherwise permitted in GC 44 WITHHOLDING OF PAYMENT AND SET OFF.

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) the Contractor's application for a Certificate of Total Performance shall constitute a waiver and release by the Contractor of any and all claims arising out of or relating to the Contract that have arisen between the date of Substantial Completion and the date of Total Completion. This waiver shall include those claims that might arise from the negligence or breach of contract by the Owner, the Engineer, and their respective employees, agents, officers, directors, and consultants, but does not include claims made by the Contractor in writing prior to such application in accordance with the Contract Documents and delivered to the Engineer and still unsettled.
- .2 The Engineer will, no later than 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 or perform Warranty Work.
- .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 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 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 20 Business Days, or such other period as set out in the Supplementary Conditions, 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; and
 - (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.

GC 43. [NOT USED]

GC 44. WITHHOLDING OF PAYMENT AND SET OFF

- .1 Subject to GC 44.2, if for any reason there are any Deficiencies, including those that require Warranty Work, 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. Such holdback shall include any costs or expenses that the Engineer believes may be reasonably incurred by the Owner or Engineer as a result of the additional Work required to rectify the Deficiencies or to complete the Work not performed. Subject to any other right the Owner may have, the holdback amount shall be paid to the Contractor upon rectification of the Deficiencies or completion of the Work not performed, less:
- (a) any actual additional costs or expenses incurred by the Owner or Engineer related to the Deficiencies and their rectification, after proper rectification of all the Deficiencies and completion of all Work; and
 - (b) any amount withheld pursuant to GC 44.1 for any Claim by third parties made against the Owner.
- .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 their 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.
- .5 The Owner shall not pay interest on any amounts withheld from the Contractor under GC 44.

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 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 TAXES AND DUTIES

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 TIMELY CONSTRUCTION

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; and
 - (k) 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 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.

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 costs and expenses including additional administrative and overhead costs and will be required to pay additional compensation to the Engineer (collectively "Additional Expenses"). 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 Expenses, 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. The Owner is not required to deduct such amounts from a current Payment Certificate but may instead deduct such amounts from a subsequent Payment Certificate or seek such amounts from the Contractor as a Claim.
- .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 regardless of any amount specified in the Supplementary Conditions, the Owner may seek to recover from the Contractor its actual losses and damages suffered or incurred in respect of Additional Expenses, 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 TERMINATION

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 5 Business Days immediately following the receipt of the Notice.
- .3 If the default cannot be corrected within the 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; and
 - (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.

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 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 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 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 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.

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 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.

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 CHANGES AND CONCEALED OR UNKNOWN CONDITIONS

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 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 A Change Order shall represent complete payment to the Contractor including for all impacts, related costs and expenses, including, without limitation time, labour, Materials, equipment, mobilization, Subcontractors, overhead, profit, insurance, bonding, and tools. The Contractor shall not be entitled to any additional change in Contract Time, Contract Price or any compensation for delay or other Claims arising from a duly executed Change Order.
- .8 The Contractor cannot reserve rights or qualify its approval of a Change Order, any attempt to do so is void and of no force and effect unless such qualification or reservation of rights is expressly agreed to in writing by the Owner.
- .9 The terms of this Contract prevail over any:
 - (a) written variation, edit, amendment or addition to the Engineer's standard form Change Order made by the Contractor that is not expressly agreed to writing by the Owner; or
 - (b) terms, conditions, or requirements in a Contractor's response or quotation to a Contemplated Change Notice that may be incorporated into a Change Order.
- .10 The Contractor may not advance, and hereby waives, any Claim based on the concept of the cumulative effect of multiple Changes.

GC 54. CONTEMPLATED CHANGE NOTICES AND CHANGE ORDERS

- .1 When a Change is proposed or required, the Engineer may provide a Contemplated Change Notice describing the proposed Change to the Contractor. Alternatively, 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 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 Changes to be paid for in whole or in part by Force Account plus a fixed or percentage fee, shall be paid in the manner set out in GC 56 FORCE ACCOUNT. The Contractor is not entitled to payment on Force Account for any non-field related costs or labour, including without limitation head office costs or overhead, personnel costs related to the review of Shop Drawings, fabrication of Drawings and coordination of Drawings, or personnel costs related to the review, consideration or implementation and processing of Changes.
- .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.

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 by the Engineer in its sole discretion by any of the following methods:
- (a) by unit prices or combination of unit prices found in the "Schedules of Quantities and Prices" in Section 00 41 00 - Bid Form;

- (b) on a Force Account basis as specified in GC 56 FORCE ACCOUNT WORK; or
 - (c) on any other basis deemed by the Engineer to represent fair and reasonable compensation to the Contractor on account of the Change Directive.
- .4 In the case of a Dispute in the valuation method of a Change Directive, the Contractor shall give Notice to the Owner and Engineer within 5 Business Days. Pending final determination of such value under Dispute, 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.
- .5 If Notice is provided by the Contractor as set out in GC 55.4, 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 55.4, the Contractor shall be deemed to have waived all of its rights to Dispute method of valuation for that Change Directive.
- .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.

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 30% of the hourly wage will be allowed to cover all costs including pension, holiday pay, payroll administration, insurance, home office overhead, and administration. Small tool allowance will be at the rate of 4% of gross cost of labour. The Contractor will be allowed a further 10% mark-up on the total of the foregoing as the allowance for overhead and a further 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 10% of cost to cover handling and indirect overhead costs, plus 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 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 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 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.
- .7 Work paid for under GC 56 FORCE ACCOUNT represents complete payment (exclusive of applicable taxes) to the Contractor for all impacts, related costs and expenses, including, without limitation: time; labour; Materials; equipment; mobilization; subcontracting; expenses; profit; general supervision; insurance; bonding; tools and equipment that are not subject to specific rental payment provisions; and all costs incurred by the Contractor in supplying Materials.

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 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 DISPUTE RESOLUTION

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 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.

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.
- .4 Nothing in this Contract shall be deemed to affect the rights of the Parties to resolve any Dispute by adjudication prescribed by applicable legislation and the processes and terms set out in PART 12 DISPUTE RESOLUTION are in addition to and supplemental to any adjudication rights available in applicable legislation.

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 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 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 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.

GC 61. MEDIATION

- .1 If the negotiation process provided for in GC 60 NEGOTIATION is initiated but a Dispute is not resolved within 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 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 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 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 INDEMNIFICATIONS AND WARRANTY

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.

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 and GC 63.4, the Warranty Period with regard to the Work begins on the date of Total Performance and continues for a period of two years, except where a longer period 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 perform the Warranty Work, at the Contractor's expense, for all Deficiencies which appear during the Warranty Period for which the Contractor is provided Notice by the Owner or the Engineer no later than 30 Business Days after the end of the Warranty Period. The cost and expense of the Warranty Work for which the Contractor is responsible includes all costs and expenses incurred by the Owner and the Engineer in facilitating, administering, or approving the Warranty Work.
- .5 The Contractor shall perform the Warranty Work promptly after Notice, provided that all Warranty Work carried out by the Contractor shall be performed during periods of time acceptable to the Owner.
- .6 In the event that the Contractor does not take steps to perform Warranty Work as required within a time period directed by or agreed upon by the Owner, the Owner may, upon expiry of 14 Business Days after giving Notice to the Contractor, take such steps as may be necessary to perform the Warranty Work. In such event, the Contractor shall promptly pay the Owner for costs incurred by the Owner the performance of the Warranty Work, including the cost to remedy any Deficiencies and to repair any other Work, if any, destroyed or damaged, or any alterations necessitated by the Contractor failing perform the Warranty Work.
- .7 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 CONFIDENTIALITY AND FREEDOM OF INFORMATION

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 INTELLECTUAL PROPERTY AND TITLE TO THE WORK

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.

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.
- .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 the Engineer to be removed from the Project Site for any reason shall revert 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.

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 37.4 in its entirety and replace with:

- .4 The Contractor shall provide Supplier's invoice, or Subcontractor's invoice supported by their supplier's invoice, to establish the value of Materials to be included in the Payment Certificate as provided for in the Supplementary Conditions. The Engineer shall not include the value of any Materials stored away from the Project Site or of any Materials stored on the site for which supporting documents have not been received from the Contractor in any Payment Certificate. The Engineer shall not delay finalization of the Payment Certificate pending receipt from the Contractor of supporting documents to establish the value of Materials stored on site.

GC 48. LATE COMPLETION

Add GC 48.4 as follows:

- .4 The pre-estimate of the Owner's Additional Expenses pursuant to GC 48.1 shall be \$1,000 per Working Day.

ADDITIONAL GENERAL CONDITIONS

The following General Conditions are hereby added:

GC 69. 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.

GC 71. PROPER INVOICES - PAYMENT CERTIFICATES - PAYMENT

- .1 Within 5 Business Days after the end of a calendar month, the Contractor will prepare and deliver to the Owner and the Engineer a Proper Invoice.
- .2 In these Supplementary Conditions a "Proper Invoice" means a request for payment for the services or Materials provided to the Project that includes the following information:
- (a) the Contractor's name and address;
 - (b) the date of the Proper Invoice and the period during which the services or Materials were supplied;
 - (c) the Contract number or Project name and any identifying number;
 - (d) a description, including quantity where appropriate, of the services or Materials that were supplied, including:
 - (i) the total value of the Work completed and the Materials incorporated into the Work; and
 - (ii) the total Quantities, or the percent complete for each pay item; and
 - (iii) the total value of Materials stored at the site awaiting incorporation into the Work.
 - (e) the amount payable for the services or Materials that were supplied, and the payment terms;
 - (f) the name, title, telephone number and mailing address of the Person to whom payment is to be sent; and
 - (g) any other information that may be required by the Lien Act.
- .3 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 Proper Invoice including inspection reports, invoices, weigh tickets and daily Force Account records.
- .4 Within 14 days of receiving a Proper Invoice, the Engineer shall prepare and issue to the Owner a Payment Certificate for the period ending the last calendar day of the preceding month that sets out:
- (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; and
 - (g) the total value of Materials stored at the site awaiting incorporation into the Work.
- .5 Within 14 days of receiving a Proper Invoice from the Contractor, the Engineer or the Owner will provide the Contractor with Notice of any non-payment in the form prescribed by the Lien Act or its regulations setting out the amount of the Proper Invoice that is being disputed by the Owner and the reasons for non-payment.
- .6 Subject to GC44 WITHHOLDING OF PAYMENT AND SET OFF, the Owner will pay the Contractor the amount set out in the Payment Certificate as due to the Contractor within 28-days of when the Owner received the Contractor's Proper Invoice.

GC 72. PROVINCIAL SALES TAX

- .1 Unit and lump sum prices and the Total Bid Price in the Bid Form are to be shown exclusive of Saskatchewan Provincial Sales Tax. The terms invoice price and price when used in the Contract Documents will be deemed exclusive of Saskatchewan Provincial Sales Tax.
- .2 Any tax rebates which may be applicable under current legislation will be claimed by the Owner and will accrue to the benefit of the Owner. The Contractor may be required to provide documentation regarding the costs of supply of certain Materials incorporated into the Work in support of the Owner's claim.
- .3 In the event the Contractor is a non-resident of Saskatchewan, the Contractor shall, upon execution of the Contract Documents, furnish written evidence in a form acceptable to the Owner:
- (a) That payment of a sum equivalent to the product of the Saskatchewan Provincial Sales Tax rate and the total contract amount has been received by the Saskatchewan Minister of Finance; or
 - (b) That a bond has been posted, in the amount of the product of the Saskatchewan Provincial Sales Tax rate and the total contract amount. The PST Guarantee Bond shall be issued by a duly licensed Surety Company acceptable to the Owner and authorized to transact a business of suretyship in the Province. The PST Guarantee Bond shall be maintained in good standing until Total Performance of the Work.

GC. 72 TARIFFS AND COST ADJUSTMENTS

- .1 The Contractor acknowledges that tariffs, duties, and other import/export fees may impact the cost of Materials and equipment required for the Work. The Contractor is responsible for identifying and accounting for all applicable tariffs at the time of bidding and shall not be entitled to claim additional compensation for tariff-related cost increases unless expressly approved by the Owner.

- .2 If the Contractor seeks compensation for tariff-related adjustments, they must submit a formal request for review. The request shall include:
- (a) Detailed Documentation - A breakdown of the specific Materials or equipment affected, including Supplier invoices, purchase orders, and shipping documents.
 - (b) Proof of Tariff Application - Official government notices, customs declarations, or other regulatory documentation confirming the imposition of the tariff and its effective date.
 - (c) Cost Comparison - A comparison between the originally estimated cost and the revised cost, highlighting the tariff's direct financial impact. Indirect financial impacts will not be considered.
 - (d) Mitigation Efforts - Evidence of efforts made to minimize tariff impacts, such as sourcing alternative Suppliers or Materials.
- .3 All tariff-related claims must be submitted within 20-days of the tariff taking effect. Failure to provide the required documentation within the specified timeframe may result in denial of the claim. The Owner and/or Engineer reserves the right to reject any claims that are inadequately substantiated or deemed unreasonable.

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 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 \$25,000.00. Such coverage to contain sublimits for Materials in transit and Materials stored at unnamed locations. Builders Risk Insurance shall be obtained and carried until Substantial 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.

Boiler and Machinery Insurance

Boiler and Machinery Insurance in the joint names of Contractor, Owner and Engineer, with the Subcontractors as unnamed insureds, insuring for not less than the replacement value of boilers, pressure vessels, electrical apparatus, mechanical apparatus and other insurable objects forming part of Work, including equipment provided by Owner for incorporation into Work.

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 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

ADDENDUM
to the
CONTRACT DOCUMENTS
for
TOWN OF OUTLOOK
RAW WATER PUMP HOUSE UPGRADES

To All Bidders:

Any changes, additions and/or deletions made to the Contract Documents for the Town of Outlook Raw Water Pump House Upgrades will be placed in this section.

Part 1 General

1.1 SUMMARY OF WORK

- .1 Requirements included:
 - .1 Title and description of Work: Town of Outlook Raw Water Pump House Upgrades. The work involves upgrades and repairs to the Town of Outlook Raw Water Pump House. The work includes civil works, structural repairs to the pumpwell walls and replacement of the existing main floor and intermediate floor, mechanical upgrades and electrical and controls upgrades.
 - .2 Contract method: Lump Sum Contract.
 - .3 Partial Owner's occupancy: Occasionally the Owner may require access to the golf course portion of the building and the Outlook West Regional Pump House Portion of the building. The facility is to remain fully operational with temporary pumping to all serviced utilities for the duration of the Work.
- .2 Drawings and Specifications furnished:
 - .1 Owner will provide one PDF copy of Drawings and Specifications to Contractor.
 - .2 Additional copies of Drawings and Specifications are available upon request at an additional cost.
 - .3 Maintain at the Project Site one complete set of Drawings and Specifications. Make available to Engineer at any time.

1.2 ALLOWANCES

- .1 Cash allowances:
 - .1 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage, installation and other authorized expenses incurred in performing the Work.
 - .2 The Contract Amount, and not the cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
 - .3 The amount of each allowance, for the Work specified in the respective specification Sections:
 - .1 Section 00 41 00 - Bid Form include stipulated sum of \$35,000.00 for material testing and asbestos abatement.

1.3 PROJECT COORDINATION

- .1 Coordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities, construction facilities and controls, and temporary pumping systems for the Town of Outlook, Outlook West Regional Water Utility and the Outlook Riverview Golf Club Pump House.

1.4 HOURS OF WORK

- .1 Perform Work in conformity with all municipal bylaws with respect to noise control, hours of Work, night Work and holiday Work.

- .2 Obtain written permission of Engineer before undertaking holiday Work or night Work.
- .3 Shutdowns of the three portions of the pump house may be required to complete portions of the work. Shutdowns shall be in accordance with Section 01 12 16 - Work Sequences and Tie-ins. No shutdown, tie-in or outage will be allowed without approval by the Owner and Engineer.

1.5 RELICS AND ANTIQUITIES

- .1 Relics and antiquities and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site or in buildings to be demolished, remain property of Owner. Protect such articles and request directives from Engineer.
- .2 Notify Engineer immediately if evidence of archaeological finds is encountered and await Engineer's written instructions before proceeding with Work in area.

1.6 CUTTING AND PATCHING

- .1 Approvals:
 - .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate Contractor.
 - .2 Inspection:
 - .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
 - .2 After uncovering, inspect conditions affecting performance of Work.
 - .3 Beginning of cutting or patching means acceptance of existing conditions.
 - .3 Execution:
 - .1 Perform cutting, fitting, and patching including excavation and fill, to complete the Work.
 - .2 Remove and replace defective and non-conforming Work.
 - .3 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
 - .4 Perform Work to avoid damage to other Work.
 - .5 Prepare proper surfaces to receive patching and finishing.
 - .6 Perform cutting and patching for weather-exposed and moisture-resistant elements and sight-exposed surfaces equivalent to original or better.
 - .7 Cut rigid materials using power saw or core drill. Pneumatic or impact tools not allowed.
 - .8 Restore Work with new products in accordance with Contract Documents.

- .9 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .10 At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated material.
- .11 Refinish surfaces to match adjacent finishes; for continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

1.7 FIELD ENGINEERING

- .1 Survey requirements:
 - .1 Provide qualified surveyor, acceptable to Owner.
 - .2 Locate, confirm and protect control points prior to starting site Work. Preserve permanent reference points during construction.
 - .3 Establish two permanent benchmarks on site, referenced to established benchmarks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
 - .4 Establish lines and levels, locate and lay out, by instrumentation.
- .2 Records:
 - .1 Maintain a complete, accurate log of control and survey Work as it progresses.
 - .2 Upon completion of foundations and major site improvements, prepare certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Subsurface conditions:
 - .1 Promptly notify Engineer in writing if subsurface conditions at Place of the Work differ materially from those indicated in Contract Documents, or reasonable assumption of probable conditions based thereon.
 - .2 After prompt investigation, should Engineer determine that conditions do differ materially, instructions will be issued for changes in the Work as provided in the contract procedures for Changes in the Work.

1.8 PROJECT MEETINGS

- .1 Administrative:
 - .1 Attend project progress meetings throughout progress of Work, approximately once per week.
 - .2 Provide physical space and make arrangements for meetings.
 - .3 Attendance is mandatory.
 - .4 Chair of the meeting will be the Owner or Engineer.
 - .5 Chair will record minutes and distribute.

1.9 SUBMITTALS

- .1 Administrative:
 - .1 Submit to Engineer for review the submittals listed. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in Work.
 - .2 Work affected by submittal shall not proceed until review is complete.

- .3 Review submittals prior to submission to Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of the Work and Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and will be considered rejected.
- .4 Verify that field measurements and affected adjacent Work are coordinated.
- .5 Adjustments made on submittals by Engineer are not intended to change the scope of Work. If adjustments affect the value of Work, state such in writing to Engineer prior to proceeding with the Work.
- .2 Shop Drawings and product data:
 - .1 The term "Shop Drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
 - .2 Indicate Materials, methods of construction and attachment or anchorage, erection diagrams, connection, explanatory notes and other information necessary for completion of Work.
 - .3 Make changes in Shop Drawings as Engineer may require.
 - .4 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submittals.
 - .5 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer's review.
 - .6 Keep one reviewed copy of each submission on site.
 - .7 Detail all Shop Drawings using the metric system. Prepare to a drafting standard equivalent to that of Contract Drawings.
 - .8 Fill in the following information on the Shop Drawing Review Stamp on each shop drawing prior to submitting the drawing to the Engineer:
 - .1 Associated Engineering job No. "2021-4675-02".
 - .2 Drawing number.
 - .9 Maintain a complete Shop Drawing record showing the review status of all Shop Drawings on the Work. Provide Engineer with a copy of this record on a monthly basis or as requested by Engineer.
 - .10 Submit Shop Drawings to Engineer for review with a transmittal form as provided by Engineer or in a form acceptable to Engineer. Type or print the appropriate information on the form to fully describe the Drawings being sent for review. Retain a photocopy of the form for filing and record purposes before Drawings are sent to Engineer.
 - .11 Transmittal form or shop drawing stamp to be signed by Contractor's authorized representative certifying approval of submission, verification of field measurements and compliance with Contract Documents.
 - .12 Submit electronic (searchable pdf) copies of product data sheets or brochures for requirements requested in Specification Sections and as Engineer may reasonably request where Shop Drawings will not be prepared due to standardized manufacture of product.
 - .13 Submit electronic files (searchable pdf) of Shop Drawings for each requirement requested in Specification Sections and as Engineer may reasonably request.

- .14 During review, Engineer will mark Drawings to indicate review status:
 - .1 "REVIEWED" - Make and distribute additional copies as required for execution of the 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 "NOT REVIEWED" - This notation indicates that Engineer has not reviewed the drawing. It may also be used in combination with the notation to revise and resubmit the drawing where Engineer lacks sufficient information to complete the review and requires resubmission of the drawing for review after revision.
 - .4 Drawings will be marked "REVIEWED" together with the notation "REVISE & RESUBMIT" when Engineer requires resubmission of a revised drawing showing corrections made as a result of Engineer'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.
- .15 Use only those Shop Drawings on the Work that bear the "REVIEWED" notation.
- .16 Do not revise Shop Drawings marked "REVIEWED" unless resubmitted to Engineer for further review.
- .17 Determine which Shop Drawings have, in addition to those Drawings specifically mentioned in Contract, design elements requiring the seal of a Professional Engineer registered in the Province or Territory where 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 Review by Engineer is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Engineer approves the detail design inherent in the Shop Drawings, responsibility for which remains with Contractor, and such review does not relieve Contractor of responsibility for errors or omissions in the Shop Drawings or of responsibility for meeting all requirements of Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the jobsite, 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.
- .3 Samples:
 - .1 Submit for review, samples in duplicate as requested in respective Specification Sections.
 - .2 Deliver samples prepaid to Engineer's business address.
- .4 Operations and maintenance manuals:
 - .1 Refer to Section 01 78 23 - Operating and Maintenance Data.

.5 Record Drawings:

- .1 After award of Contract, Engineer will provide a set of Drawings for purpose of maintaining record Drawings. During progress of the Work, accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Engineer.
- .2 Record locations of concealed components of mechanical and electrical services.
- .3 Identify Drawings as "Project Record Copy". Maintain in good condition, keep continuously updated and make available for inspection on site by Engineer.
- .4 On completion of Work and prior to final inspection, submit record documents to Engineer.

1.10 SCHEDULE

.1 Schedules required:

- .1 After award of the contract, submit a detailed construction schedule clearly showing the sequence and interdependence of construction activities and indicate the start and completion of major items of Work, and interim milestone completion dates.
- .2 Submittal schedule for shop drawings, product data and samples.
- .3 During progress of Work update and resubmit construction schedule monthly.

.2 Format:

- .1 Prepare schedule in form of horizontal bar chart.
- .2 Provide separate bar for each trade or operation.
- .3 Provide horizontal time scale identifying first workday of each week.
- .4 Format for listings: Chronological order of start of each item of work.

.3 Submission:

- .1 Baseline construction schedule:
 - .1 Submit construction schedule in accordance with Division 01.
- .2 Construction schedule updates:
 - .1 Submit updated construction schedule monthly to reflect actual progress and occurrences to date, including any weather delays noted. Clearly indicate the work that has been completed to within 5-days of the date of the submission and the work to be completed. Highlight changes that have been made in respect to the initial detailed progress schedule.
- .3 Timely submissions of the schedule submittals described herein are of significant and crucial importance to the Project. Lack of or late receipt of the submittals diminishes their value to the Project, Contractor and Owner. In the event that any or all of these submissions are late or not submitted, the Owner may withhold from the progress payment the amount of 20% of the total of any amounts, net of value-added taxes, due to the Contractor. This withholding will apply to each month for which such item or items is not complete and up to date. The applicable withholding will be released with the next monthly progress payment the late or absent submittals are completed and up to date.

- .4 Contents:
 - .1 Schedule shall begin with the date of Notice to Proceed and conclude with the date of completion.
 - .2 Identify work calendar basis using days as a unit of measure.
 - .3 Show complete interdependence and sequence of construction and project related activities reasonably required to complete the Work.
 - .4 Identify the work of separate stages and other logically grouped activities and clearly identify critical path of activities.
 - .5 Reflect sequences of the Work, restraints, delivery windows, review times, Contract times and project milestones.
- .5 Include as applicable, at a minimum:
 - .1 Mobilization and other preliminary activities.
 - .2 Initial site work.
 - .3 Specified work sequences, constraints and milestones, including Substantial Performance date(s).
 - .4 Subcontract work:
 - .1 Process mechanical work.
 - .2 Electrical work.
 - .3 Instrumentation and controls work.
 - .4 Integration and commissioning.
 - .5 Temporary works.
 - .6 Demolition.
 - .7 Sitework.
 - .8 Excavations.
 - .9 Underground pipelines.
 - .10 Shoring.
 - .11 Concrete work.
 - .12 Structural steel work.
 - .13 Architectural features work.
 - .14 Conveying systems work.
 - .15 Equipment work.
 - .16 Mechanical work.
 - .17 Electrical work.
 - .18 Instrumentation and controls.
 - .19 Cathodic protection.
 - .20 Leakage testing of structure.
 - .21 Other important work for each major facility.
 - .22 Equipment and system start-up and test activities.
 - .23 Commissioning.
 - .24 Substantial completion.
 - .25 Project cleanup.
 - .26 Demobilization.
 - .27 Warrantee and close out.

- .6 No activity duration, exclusive of those for submittals review and product fabrication/delivery, shall be less than 1-day or more than 30-days, unless otherwise approved.
- .7 The critical path shall be clearly identifiable on all submissions.
- .8 If Contractor fails to complete activity by its latest scheduled completion date and this failure is anticipated to extend Contract times (or milestones), Contractor shall, within 5-business-days of such failure, submit a written statement as to how Contractor intends to correct non-performance and return to acceptable current construction schedule. Actions by Contractor to complete the Work within Contract times (or Milestones) will not be justification for adjustment to Contract price or Contract times.
- .9 Owner may order Contractor to increase plant, equipment, labour force, or working hours, at no additional cost to Owner, if Contractor fails to:
 - .1 Complete a milestone activity by its completion date.
 - .2 Satisfactorily execute Work as necessary to prevent delay to overall completion of Project.

1.11 QUALITY CONTROL

- .1 Inspection:
 - .1 Owner and Engineer shall have access to Work.
 - .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Engineer instructions, or law of Place of Work.
 - .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .2 Independent inspection agencies:
 - .1 Particular requirements for inspection and testing to be carried out by an independent testing laboratory approved by Engineer are specified under various sections.
 - .2 All costs for quality control services of testing laboratories shall be borne by the Contractor.
 - .3 Contractor's responsibilities:
 - .1 Furnish labour and facilities to:
 - .1 Provide access to work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Make good work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
 - .2 Notify testing laboratory sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
 - .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
 - .4 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Engineer.

- .3 Access to Work:
 - .1 Allow inspection/testing agencies access to Work, offsite manufacturing and fabrication plants.
 - .2 Cooperate to provide reasonable facilities for such access.
- .4 Procedures:
 - .1 Notify the appropriate agency and Engineer in advance of the requirement for tests, in order that attendance arrangements can be made.
 - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.
 - .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
- .5 Reports:
 - .1 Submit electronic copies of mix designs and inspection and test reports promptly to Engineer.
 - .2 Provide copies to Subcontractor of work being inspected/tested.

1.12 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- .1 Installation/removal:
 - .1 Provide construction facilities and temporary controls in order to execute Work expeditiously.
 - .2 Remove from site all such Work after use.
- .2 Hoarding:
 - .1 Erect hoarding around entire perimeter of site to protect public, workers, public and private property from injury or damage.
 - .2 Provide hoarding with chain link fence around entire perimeter of each site, to protect public and private property from injury or damage. Provide lockable gates within hoarding for access to site by workers and vehicles
- .3 Weather enclosures:
 - .1 Provide weathertight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
 - .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior Work area for temporary heat.
- .4 Dust tight screens:
 - .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
 - .2 Maintain and relocate protection until such Work is complete.
- .5 Dewatering:
 - .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

- .6 Site storage/loading:
 - .1 Confine the Work and operations of employees to limits indicated by Contract Documents. Do not unreasonably encumber premises with products.
 - .2 Do not load or permit to be loaded any part of the Work with a weight or force that will endanger the Work.
- .7 Sanitary facilities:
 - .1 Provide sufficient sanitary facilities for workers in accordance with local health authorities.
 - .2 Maintain in clean condition.
 - .3 Existing facilities as designated may be used during construction period.
- .8 Water supply:
 - .1 Provide a continuous supply of potable water for construction use.
 - .2 There are no potable water connection tie-in locations at the work site. Portable jugs will be required for potable water for worksite.
- .9 Temporary heating:
 - .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
 - .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders not permitted.
 - .3 Maintain temperatures of minimum 10°C in areas where construction is in progress, unless indicated otherwise in Specifications.
 - .4 Ventilate heated areas and keep building free of exhaust or combustion gases.
 - .5 Permanent heating system of building, or portions thereof, may be used when available. Be responsible for damage thereto.
- .10 Temporary power:
 - .1 Where available, Owner will allow the Contractor to utilize existing power required during construction for temporary lighting and operating of power tools, to maximum supply of 220 V, 30 A. Where power requirement exceeds 220 V, 30 A or power is not available, the Contractor is responsible to provide and pay for the temporary power required. Contractor to obtain Owner approval prior to installation of temporary power.
- .11 Equipment/tool/materials storage:
 - .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and Materials.
 - .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with Work activities.
- .12 Project cleanliness:
 - .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris.

- .2 Provide on-site waste containers for collection of waste materials and debris and be responsible for the removal of waste materials from site at regularly scheduled intervals. Note that local landfill facilities are not available; therefore, the Contractor shall arrange for disposal at a suitable location.
- .3 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.13 BASIC PRODUCT REQUIREMENTS

- .1 Product and material quality:
 - .1 Products, materials, equipment and articles (referred to as Products throughout Specifications) incorporated in Work shall be new, not damaged or defective, and conforming with Specifications for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
 - .2 Defective products will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .2 Storage, handling and protection:
 - .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact.
 - .3 Store products subject to damage from weather in weatherproof enclosures.
- .3 Manufacturer's instructions:
 - .1 Unless otherwise indicated in Specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from Manufacturers.
 - .2 Notify Engineer in writing, of conflicts between Specifications and manufacturer's instructions, so that Engineer may establish course of action.
 - .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Engineer to require removal and reinstallation at no increase in Contract Amount.
- .4 Workmanship:
 - .1 Execute Work by workers experienced and skilled in respective duties for which they are employed. Immediately notify Engineer if required Work is such as to make it impractical to produce required results.
 - .2 Do not employ any unfit Person or anyone unskilled in their required duties. Engineer reserves the right to require the dismissal from site of workers deemed incompetent, careless, insubordinate or otherwise objectionable.
- .5 Concealment:
 - .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

- .2 Before installation, inform Engineer if there is a contradictory situation. Install as directed by Engineer.

1.14 PROJECT CLOSEOUT

- .1 Final cleaning:
 - .1 Refer to Division 01.
- .2 Systems demonstration:
 - .1 Refer to Division 01.
- .3 Documents:
 - .1 Collect reviewed submittals and assemble documents executed by Subcontractors, Suppliers, and Manufacturers.
 - .2 Submit material prior to final Application for Payment.
 - .3 Submit operation and maintenance data, record drawings.
 - .4 Provide warranties and bonds fully executed and notarized.
 - .5 Execute transition of Performance and Labour and Materials Payment Bond(s) to warranty period requirements.
 - .6 Submit a final statement of accounting giving total adjusted Contract Amount, previous payments, and monies remaining due.
 - .7 Engineer will issue a final change order reflecting approved adjustments to Contract Amount not previously made.
- .4 Inspection/takeover procedures:
 - .1 Prior to application for Certificate of Total Performance carefully inspect the Work and ensure it is complete, that all construction deficiencies are complete, defects are corrected, and building is clean and in condition for occupancy.
 - .2 In accordance with Division 01, notify Engineer, in writing, of completion of the Work and request an inspection.
 - .3 During Engineer inspection, a list of deficiencies and defects will be tabulated. Correct same.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Contractor shall take the necessary measures to ensure uninterrupted operation of all facilities through the course of construction. If an interruption in service is necessary to complete work, the Contractor shall notify the Engineer and submit a detailed work plan to carry out the interruption 4-weeks prior to the work. Work plan is to include emergency and contingency planning. Work shall not proceed without approval from the Engineer and Owner.
- .2 Contractor shall take adequate measures to protect all existing essential mechanical, electrical and control equipment through the course of construction.
- .3 The Contractor shall provide temporary pumping, mechanical, electrical, and controls equipment as required to maintain uninterrupted operation of all facilities.
- .4 The Contractor shall provide temporary heating and hoarding as required to ensure all existing equipment is adequately protected during all demolition activities.
- .5 Provide all necessary temporary provisions subsequent to all activities as required. Contractor to make all provisions necessary to prevent flooding and/or treated water contamination.
- .6 In order to accommodate the work, coordinate with the Owner's operations personnel to operate existing valves or circuit breaker as needed. Other activities such as additional isolation, dewatering, de-commissioning, de-energizing and de-pressurizing will be done by the Contractor. Where such isolation, dewatering, de-commissioning, de-energizing and de-pressurizing require disassembly, such work is to be done by the Contractor including any associated clean-up and testing. Perform all such work in accordance with the shutdown plan submitted by the Contractor and approved by the Engineer.
- .7 Some shutdowns may have to take place outside of normal working hours (i.e., nighttime and/or weekends).

1.2 CONTINUITY OF OPERATIONS

- .1 Coordinate the Work to avoid any interference with normal operation of all facilities.
- .2 The work sequences and tie-in procedures specified in this Section should enable the Contractor to perform construction activities concurrently with Owner's operation activities required to maintain sanitary sewer and water treatment operations. The Contractor may propose alternative work sequences or procedures that maintain operations, for the approval of the Engineer. Alternate work sequences are to be submitted for review 4-weeks prior to execution of the respective Work.

- .3 Ensure that access is maintained for all operation and maintenance requirements of all facilities at all times, housekeeping is maintained at the highest possible level to minimize interference, and the existing facilities are maintained in weather-tight conditions.
- .4 Complete all tie-ins to existing facilities in the shortest practical timeframe to minimize interferences. Scheduling must reflect this priority.

1.3 SHUTDOWN AND TIE-IN PLANS

- .1 Interruptions in service to sanitary sewer, raw water supply, water treatment, and potable water distribution systems will only be permitted under special circumstances and must be planned for 4-weeks in advance of the work activity.
- .2 All shutdown or tie-in plans are to be submitted 4-weeks prior to the work to allow for review by Owner and Engineer.
- .3 Prepare a detailed plan for any shutdown, tie-in or construction activity which will potentially affect existing operations, describing temporary provisions, the length of time required to complete, contingency plans, and the necessary personnel and equipment which the Contractor will provide in order to prevent interruptions in service:
 - .1 For all electrical and control tie-ins and shutdowns, identify at a minimum the known affected electrical equipment and all subsequently affected known loads. Clearly identify the affected loads and connections within a dedicated section of each submitted Tie-in and Shutdown Plan.
- .4 Prepare and submit the shutdown or tie-in plan to the Engineer prior to conducting a scheduled shutdown or tie-in. Allow sufficient time for review by the Engineer, followed by a meeting to be held between the Engineer, Owner's operations personnel, and the Contractor to discuss activities and responsibilities relating to the shutdown or tie-in and potential limitations and requirements not addressed in the plan.

1.4 CONSTRUCTION SEQUENCE

- .1 The Contractor shall sequence construction activities as required to accommodate the construction constraints outlined within Clause 1.5 - Construction Constraints. To achieve this, it is recommended that the Contractor consider the following construction sequences in planning the Work:
 - .1 Outlook Raw Water Pumphouse, Riverview Golf Club Pumphouse, and the Outlook West Rural Pipeline Association Pumphouse:
 - .1 The Town of Outlook Raw Water Pumphouse supplies water to the Outlook West Rural Pipeline Association Pumphouse pumpwell and the Riverview Golf Club Pumphouse pumpwell. During periods when the Town of Outlook raw water pumpwell is out of service temporary pumping is to be provided from the upstream intake manhole to the Town of Outlook Water Treatment Plant, Riverview Golf Club system and the Outlook West Regional Water Pumphouse.

- .2 Town of Outlook Raw Water Pumphouse:
 - .1 To prepare for the work required in the Town of Outlook Raw Water Pumphouse and Pumpwell, the Contractor shall first excavate for the raw water supply piping for the Town of Outlook system as identified in the Drawing Package and install the new buried underground piping complete with cleanout manhole to provide a tie-in location for the temporary pumping system. The raw water tie-in will require a shutdown for the Town of Outlook raw water supply line and water treatment plant which is to be coordinated with the Owner and Engineer, via a Work Plan.
 - .2 Once the buried piping is completed, the Contractor shall set up temporary pumping from the manhole upstream of the Raw Water Pumphouse:
 - .1 The Contractor shall install a temporary pump and connect to one of the existing pump starters for the Town of Outlook Raw Water Pumphouse to maintain the controls from the water treatment plant or provide new control system to a new temporary starter for the temporary pump.
 - .2 Once the temporary system is connected and the Owner has confirmed the system is working satisfactorily, isolation of the Town of Outlook Raw Water Pumphouse pumpwell can be completed.
 - .3 Complete demolition per the Drawing Package. Electrical and Controls system to remain functional for the temporary raw water pumping system.
 - .4 Following demolition of mechanical and structural components, complete the structural and mechanical upgrades within the pumphouse.
 - .5 Once the mechanical and structural upgrades are completed within the pumphouse, phase electrical installation to accommodate the temporary system and install new pump starter and associated electrical, instrumentation and controls for one permanent pump within the pumphouse.
 - .6 Following commissioning of the electrical, instrumentation and controls systems, remove the temporary pumping system and remaining electrical equipment to accommodate installation of remaining pump starter, associated electrical, instrumentation and controls equipment.
 - .7 Fully commission the upgraded pumphouse facility.
- .3 Riverview Golf Club Pumphouse:
 - .1 The Riverview Golf Club pumphouse pumpwell is interconnected to the Town of Outlook Raw Water Pumphouse Pumpwell and requires temporary pumping until the Town of Outlook Raw Water Pumpwell can be flooded.

- .2 To prepare for the work required in the Town of Outlook Raw Water Pumphouse and Pumpwell, the Contractor shall first set up temporary pumping systems and make connection to the Riverview Golf Club supply header within the golf course facility:
 - .1 The temporary pumping system can be set up from the manhole upstream of the Town of Outlook Raw Water Pumphouse.
 - .2 To accommodate the temporary pumping system, a tie in location will need to be installed into the Riverview Golf Club Pumphouse supply header. The temporary pump shall match the existing Golf course submersible pump and electrical can be fed from the existing starter located within the golf course pumphouse connected to the Town of Outlook Raw Water Pumphouse.
 - .3 Once the temporary system is connected and the Owner has confirmed the system is working satisfactorily, isolation of the Town of Outlook Raw Water Pumphouse pumpwell can be completed.
 - .4 Complete the remainder of work in the Town of Outlook Raw Water Pumphouse pumpwell which requires isolation.
 - .5 Once isolation is no longer required, reconnect existing pumping system to original condition and turnover pump to Owner.
- .4 Outlook West Regional Water Pumphouse:
 - .1 The Outlook West Rural Pipeline Association pumphouse pumpwell is interconnected to the Town of Outlook Raw Water Pumphouse Pumpwell and requires temporary pumping until the Town of Outlook Raw Water Pumpwell can be flooded following completion of the structural work in the lower level.
 - .2 To prepare for the work required in the Town of Outlook Raw Water Pumphouse and Pumpwell, the Contractor shall first set up temporary pumping systems and make connection to the Outlook West Rural Pipeline Association supply header within the Outlook West pumphouse portion of the building.
 - .1 The temporary pumping system can be set up from the manhole upstream of the Town of Outlook Raw Water Pumphouse.
 - .2 To accommodate the temporary pumping system, a blind flange and isolation valve exist within the Outlook West facility which connects to the raw water supply header. The temporary pump shall be Owner supplied and matches the existing submersible pump currently installed at the facility and electrical can be fed from the existing starter located within the Outlook West pumphouse connected to the Town of Outlook Raw Water Pumphouse.

- .3 Once the temporary system is connected and the Owner has confirmed the system is working satisfactorily, isolation of the Town of Outlook Raw Water Pumphouse pumpwell can be completed.
- .4 Complete the remainder of work in the Town of Outlook Raw Water Pumphouse pumpwell which requires isolation.
- .5 Once isolation is no longer required, reconnect existing pumping system to original condition and turnover pump to Owner.

1.5 CONSTRUCTION CONSTRAINTS

- .1 Further to that specified above, the Contractor shall conduct the Work in a fashion that maintains continuous operation of all facilities. To permit this, the Contractor shall abide by the construction constraints outlined below. The construction constraints are provided as the minimum standard and must be strictly adhered to in the planning and scheduling processes. At any time, the Engineer or Owner may impose additional constraints required to permit continuous operation of the facilities. The Contractor shall, at no additional cost to the Owner, be required to abide by the constraints stipulated herein and those imposed through execution of the Work.
 - .1 Outlook Raw Water Pumphouse:
 - .1 To permit installation of the buried piping and connection to the existing raw water supply header as shown in the Contract Drawings, the Contractor may cause a one-time disruption of the supply of raw water supply line connected to the Outlook Water Treatment Plant. This disruption of service may only occur between the hours of 10:00 p.m. and 5:00 a.m. Otherwise, maintain continuous supply of raw water to the connected supply system.
 - .2 Shutdowns to the existing Town of Outlook Raw Water Supply System shall be in accordance with the following:
 - .1 Shutdowns between May 15th and September 15th shall not be permitted.
 - .2 Shutdowns shall be limited to a maximum of 24-hours between September 16th and May 14th.
 - .2 Riverview Golf Club Pumphouse:
 - .1 To permit installation of the connection to the Riverview Golf Club pumphouse supply header, the Contractor may cause a one-time disruption of the supply of raw water supply line connected to the Riverview Golf Club. This disruption of service may only occur between the hours of 9:00 a.m. and 5:00 p.m. Otherwise, maintain continuous supply of raw water to the connected supply system.
 - .2 Shutdowns to the existing Riverview Golf Club Pumphouse shall be in accordance with the following:
 - .1 Shutdowns between May 15th and September 15th shall not be permitted.
 - .2 Shutdowns shall be limited to a maximum of 24-hours between September 16th and May 14th.

- .3 Outlook West Rural Pipeline Association Pumphouse:
 - .1 To permit installation connection to the Outlook West Pipeline Association pumphouse supply header, the Contractor may cause a one-time disruption of the supply of potable water to the connected distribution system. This disruption of service may only occur between the hours of 10:00 p.m. and 5:00 a.m. Otherwise, maintain continuous supply of potable water to the connected distribution system.
 - .2 Shutdowns to the existing Outlook West Rural Pipeline Association Pumphouse shall be in accordance with the following:
 - .1 Shutdowns between May 15th and September 15th shall not be permitted.
 - .2 Shutdowns shall be limited to a maximum of 24-hours between September 16th and May 14th.

1.6 SUBMITTALS FOR REVIEW

- .1 In accordance with Division 01, submit a detailed shutdown or tie-in plan and schedule no later than 4-weeks prior to the scheduled shutdown or tie-in. No shutdown, tie-in or outage will be allowed without approval by the Engineer and Owner. Coordinate the shutdown or tie-in with the Construction Schedule and Owner's operations personnel.
- .2 Contractor to submit detailed plan in a form suitable to the Engineer.

1.7 FAILURE TO SUBMIT AND COMPLY WITH WORK PLAN AND TEMPORARY SYSTEMS REQUIREMENTS

- .1 Precondition to Work:
 - .1 No construction activity, shutdown, or tie-in affecting existing operations shall proceed until the Contractor has submitted the required Work Plan, including temporary systems and contingency measures, and such Work Plan has been reviewed and accepted by the Engineer and Owner.
- .2 Failure to submit Work plan:
 - .1 If the Contractor fails to submit a Work Plan in accordance with this Section:
 - .1 Any construction activity, shutdown, or tie-in undertaken without submission and acceptance of the required Work Plan shall be deemed non-compliant, and the Engineer may exclude such work from the Payment Certificate or recommend withholding of payment in accordance with the Contract Documents until the Contractor has satisfied the requirements of this Section; and
 - .2 Any delay resulting from such failure shall be deemed the sole responsibility of the Contractor, with no entitlement to extension of Contract Time or additional compensation.
- .3 Failure to provide adequate temporary systems:
 - .1 If the Contractor proceeds with Work without implementing the temporary systems required to meet the constraints of this Section (including but not limited to continuous operation, protection of facilities, and regulatory compliance):
 - .1 The Work shall be deemed deficient and non-compliant;

- .2 The Engineer may order immediate suspension of the affected Work; and
- .3 The Contractor shall, at its own cost, implement all necessary temporary systems and rectify any resulting impacts, damages, or service disruptions.
- .4 Owner's right to intervene:
 - .1 Where the Contractor fails to provide acceptable temporary systems or comply with the approved Work Plan, the Owner may, upon Notice, implement such temporary systems or corrective measures as are deemed necessary, and all associated costs shall be the responsibility of the Contractor and may be recovered by the Owner, including through withholding of payment or set-off against amounts otherwise due to the Contractor, in accordance with the Contract Documents.
- .5 Liability for disruption:
 - .1 The Contractor shall be fully responsible for all operational disruptions, environmental non-compliance, damages, or third-party impacts arising from failure to:
 - .1 Submit an acceptable Work Plan; or
 - .2 Provide and maintain required temporary systems.
 - .2 Such failures may also constitute default under the Contract, subject to remedies in the General Conditions (including termination for default).
- .6 No additional compensation:
 - .1 No additional payment or extension of Contract Time shall be granted for any costs, delays, or inefficiencies resulting from the Contractor's failure to comply with this Section.
- .7 Repeated failure to comply with the requirements of this Section shall be deemed a material breach of Contract.

Part 2 **Products**
Not used.

Part 3 **Execution**
Not used.

END OF SECTION

Part 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 For lump sum price item, Engineer will calculate payment based on tendered price and Engineer's estimate of percentage of work item completed.
- .2 Where a method of measurement for payment for a work item is not specified, payment for that item will be deemed to be included in another pay item or other pay items.

1.2 PROGRESS PAYMENTS

- .1 Refer to GC 37 - PROGRESS PAYMENTS and GC 71 - PROPER INVOICES - PAYMENT CERTIFICATES - PAYMENT.
- .2 Contractor's Responsibilities:
 - .1 Submit Proper Invoice to Engineer within 5-working-days after each month end. Claim to cover preceding month.
 - .2 Proper Invoice to show estimate of percentage of work completed against each item of Lump Sum Price Breakdown.
 - .3 Proper Invoice to include all labour and materials incorporated in Work and all materials stored at Site.
 - .4 Proper Invoice to include all agreed extras and deductions.
 - .5 Supply documentation to support claim for materials on site in the form of itemized lists or unpriced purchase orders showing quantities.
 - .6 Supply other evidence required by Engineer in support of Proper Invoice.
- .3 Engineer's Responsibilities:
 - .1 Review Contractor's claim, prepare Progress Payment Certificate and issue to Owner within 10-working-days following receipt of Contractor's claim.
 - .2 Engineer's estimate of percentage of work completed will govern calculation of payment on all Progress Payment Certificates.
 - .3 Inform Contractor of amendments to claim by copy of Progress Payment Certificate.

1.3 CHANGES

- .1 Refer to GC 53 - CHANGES.

Part 2 Products
Not used.

Part 3 **Execution**
Not used.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS INCLUDED

- .1 Regulations affecting the Work imposed by:
 - .1 Saskatchewan Ministry of Highways and Infrastructure.
 - .2 CN Rail.
 - .3 CP Rail.
 - .4 National Transportation Agency of Canada.
 - .5 Saskatchewan Water Security Agency.
 - .6 Saskatchewan Ministry of Environment.
 - .7 Saskatchewan Power Corporation (SaskPower).
 - .8 Saskatchewan Water Corporation (SaskWater).
 - .9 Saskatchewan Telecommunications (SaskTel).
 - .10 Saskatchewan Energy (SaskEnergy).
 - .11 Fisheries and Oceans Canada.
 - .12 Navigation Protection Act.
 - .13 Environment Canada.
 - .14 National Energy Board.
 - .15 TransCanada Pipelines.
 - .16 National Building Code.
 - .17 Occupational Health and Safety.
 - .18 Municipal by-laws and servicing standards.
 - .19 Municipal utilities.
 - .20 Regional Water and Sewer Commission.

1.2 COMPLIANCE WITH REGULATIONS

- .1 Ascertain requirements and regulations of authorities listed above.
- .2 Comply with all such requirements and regulations as applicable to the Work.
- .3 Requirements set out in this Section are for guidance and information and are not necessarily complete.

1.3 PERMITS

- .1 Notwithstanding the provisions of GC 14 - Activities, Owner will obtain construction permits required from:
 - .1 Water Security Agency (Permit to Construct a Waterworks).
- .2 Obtain all construction permits necessary for the Works other than those listed under the above item.

1.4 WORK IN VICINITY OF OVERHEAD POWER LINES

- .1 Request power company to relocate, de-energize or guard any energized conductor where Construction Equipment may operate within 3 m of conductor.
- .2 Obtain power company approval prior to operating any equipment within 3 m of energized conductor.
- .3 Where practical, avoid storage of metallic pipe sections under high voltage overhead power lines.
- .4 If pipe sections must be stored under power lines, protect Personnel from effects of induced currents by grounding pipe sections at two locations with AWG #2 copper ground conductors and grounding rods.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 LATEST EDITIONS

- .1 All references to Specifications, standards, or methods of technical associations refer to the latest adopted revision, including all amendments, in effect on the date of submission of bids, except where a date or issue is specifically noted.

1.2 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AFBMA	Antifriction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
ARI	Air-Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWMAC	Architectural Woodworkers Manufacturers Association of Canada
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
CAN	Canadian National Standard
CBM	Certified Ballast Manufacturers
CBTIC	Clay Brick and Tile Institute of Canada
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CGA	Canadian Gas Association
CGRA	Canadian Good Roads Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CITC	Canadian Institute of Timber Construction
CLA	Canadian Lumbermen Association
CMAA	Crane Manufacturers Association of America
CMHC	Canada Mortgage and Housing Corporation
CPCA	Canadian Painting Contractors Association
CPCI	Canadian Prestressed Concrete Institute
CRCA	Canadian Roofing Contractors Association
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSSBI	Canadian Sheet Steel Building Institute
CUA	Canadian Underwriters Association
CWB	Canadian Welding Bureau
CWC	Canadian Wood Council
CSPI	Corrugated Steel Pipe Institute

EEI	Edison Electric Institute
EEMAC	Electrical and Electronic Manufacturers of Canada
FFPC	Federal Fire Prevention Committee
FM	Factory Mutual Engineering Corporation
IAO	Insurers' Advisory Organization
IBRM	Institute of Boiler and Radiator Manufacturers
IEC	International Electrotechnical Commission
IEE	Institution of Electrical Engineers (U.K.)
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IGMAC	Insulated Glass Manufacturers Association of Canada
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	International Standardization Organization
LEMA	Lighting Equipment Manufacturers Association
LTIC	Laminated Timber Institute of Canada
MMA	Millwork Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NBC	National Building Code of Canada
NEC	National Electrical Code
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NLGA	National Lumber Grade Authority
OECI	Overhead Electrical Crane Institute
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
RLM	RLM Standards Institute
RTAC	Road and Transportation Association of Canada
SAE	Society of Automotive Engineers
SBI	Steel Boilers Institute
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
TTMAC	Terrazzo, Tile and Marble Association of Canada
ULC	Underwriters' Laboratories of Canada
USFG	United States Federal Government
WCB	Workers' Compensation Board

1.3 CONFORMANCE

- .1 Conform to these standards, in whole or in part as specifically requested in Specifications.
- .2 If there is question as to whether any product or system is in conformance with applicable standards, Engineer reserves the right to have such products or systems tested to prove or disprove conformance.
- .3 The cost for such testing will be born by Owner in the event of conformance with Contract Documents or by Contractor in the event of non-conformance.

Part 2 **Products**
Not used.

Part 3 **Execution**
Not used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Make submittals in accordance with Division 01.
- .2 Submit site specific Health and Safety Program: within 14-days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Program must include:
 - .1 Results of site-specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
- .3 Submit Construction Safety Checklists after completion.
- .4 Submit copies of all reports or directives issued by Federal and/or Provincial health and safety inspector(s).
- .5 Submit copies of incident and accident reports.
- .6 Submit on site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
- .7 Submit Material Safety Data Sheets (MSDS).
- .8 Submit Personnel training requirements including names of personnel and alternates responsible for site safety and health, hazards present on site, and use of personal protective equipment.
- .9 Submit, and post at the Work site, the emergency numbers for police, fire and ambulance for the locale of the Work, as well as the names and after-hours numbers for key site personnel related to health, safety or security of the site.

1.2 SAFETY ASSESSMENT

- .1 Perform site-specific safety hazard assessment related to Project.
- .2 Submit hazard assessment report to Engineer.

1.3 MEETINGS

- .1 Attend health and safety preconstruction meeting.
- .2 Arrange for "toolbox" safety meetings and submit reports.

1.4 REGULATORY REQUIREMENTS

- .1 Comply with specified standards and regulations to ensure safe operations at site containing hazardous or toxic materials.

1.5 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Program based on hazard assessment prior to commencing any site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Program must address project Specifications.
- .2 Correct deficiencies and resubmit Health and Safety Program when so requested by Engineer.

1.6 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial, and local statutes, regulations, and ordinances, and with site specific Health and Safety Program.

1.7 COMPLIANCE REQUIREMENTS

- .1 Comply with OH&S Legislation

1.8 UNFORESEEN HAZARDS

- .1 Should any unforeseen or peculiar safety related factor, hazard, or condition become evident during performance of Work, immediately stop Work and follow procedures in place for employee's right to refuse Work in accordance with the OH&S Legislation. Advise Engineer verbally and in writing.

1.9 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety noncompliance issues identified by Engineer or designated safety inspector.
- .2 Provide Engineer with written report of action taken to correct noncompliance of health and safety issues identified.
- .3 Be aware that Engineer may stop Work if noncompliance of health and safety regulations is not corrected.

1.10 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site Personnel and protection of environment over cost and schedule considerations for Work.
- .2 Stop Work when necessary or advisable for reasons of health and safety.
- .3 Be aware that Engineer or designated safety inspector may stop Work when deemed necessary or advisable for reasons of health and safety.

Part 2 **Products**
Not used.

Part 3 **Execution**
Not used.

END OF SECTION

Part 1 General

1.1 MATERIALS

- .1 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material Manufacturer.

1.2 FINAL CLEANING

- .1 In preparation for Certificate of Total Performance of the project, perform final cleaning.
- .2 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .3 Remove waste products and debris other than that caused by Owner or Other Contractors.
- .4 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .5 Clean roofs, downspouts, and drainage systems.
- .6 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from interior and exterior finished surfaces including glass and other polished surfaces.
- .7 Clean lighting reflectors, lenses, and other lighting surfaces.
- .8 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .9 Wax, seal, shampoo or prepare floor finishes, as recommended by Manufacturer.
- .10 Broom clean paved surfaces; rake clean other surfaces of grounds.
- .11 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .12 Remove snow and ice from access to building.
- .13 Inspect valve boxes, manholes and hydrants to check for debris and proper operation.
- .14 Operate valves, including those existing prior to construction, to ensure that no damage has occurred or debris accumulated, due to cleanup activities.

Part 2 Products

Not used.

Part 3 **Execution**
Not used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Requirements for placing Work in a state of readiness for acceptance by Owner.
- .2 Section supplements, but does not supersede, specific requirements of other Sections.

1.2 DEFINITIONS

- .1 Commissioning (Cx): the process of planning, documenting, verifying, and training, to provide a facility that operates as a fully functional system in accordance with the Contract Documents.
- .2 Pre-start-up: pre-start-up consists of the non-operating functions required to bring Work to a state of readiness for placing systems into service. It includes but is not limited to cleaning, leakage and pressure testing, cold alignment checks, disinfection, system flushing, lubrication of mechanical equipment, rotation checks and wiring loop checks. Contractor shall conduct inspections of all components and sub-components and shall arrange for inspections of equipment installations by qualified equipment Manufacturers' representatives as required by Contract Documents. At this stage, deficiency lists are prepared, and Contractor is to remedy outstanding incomplete or incorrect work in accordance with terms of Contract. Equipment Installation Certification Forms shall be prepared by Contractor certifying that each piece of equipment has successfully undergone pre-start-up and is ready for start-up.
- .3 Start-up: once each piece of equipment within the defined system has successfully undergone Pre-start-up, then that individual system shall be started and tested. Both "Dry Run" and "Wet-Run" tests are required. Contractor shall conduct performance tests of all equipment in conjunction with the Manufacturer's representatives as required by the Contract Documents and under the witness of Engineer. Deficiencies that are uncovered shall be corrected and retesting shall be conducted as required. Start-up Certification Forms shall be prepared by Contractor certifying that the equipment or system is complete, successfully tested, started and ready to undergo Functional Performance Testing.
- .4 Functional performance testing (FPT): FPT shall consist of a full range of tests under actual load, conducted to verify that the operation of specific systems, subsystems, components, and interfaces between systems have been installed and activated to operate in conformance with the Contract Documents. FPT procedures shall include checks and tests to be carried out, recorded, and documented. FPT shall apply to all systems, subsystems, and components, and shall proceed in sequence, starting with components and concluding with the complete system and its integration with all other systems included within the Work. Functional Performance Testing Certification Forms shall be completed by the Contractor certifying that the system is complete, successfully tested, and ready for continuous operation.

- .5 System verification: system verification consists of placing all the various systems in the Works into continuous operation in an orderly manner. System verification is complete when all systems have been operating continuously for a specified period without fault and in accordance with the specified performance requirements.

1.3 Cx PLAN

- .1 The Contractor shall develop and maintain the Cx Plan (CxP).
- .2 The Contractor shall facilitate Cx program workshops as required to solicit input from the Engineer and Owner in the development of the CxP.
- .3 The project specific CxP shall be prepared to overview and detail the Cx Program and include the following, as a minimum:
 - .1 Objectives.
 - .2 Facilities to be commissioned.
 - .3 Team roles, responsibilities and contact information.
 - .4 Initial operating conditions and parameters.
 - .5 Intended final operating conditions and parameters.
 - .6 Reviewed CxS design.
 - .7 CxS implementation plan.
 - .8 Laboratory requirements or arrangements for outside testing services.
 - .9 Sampling and monitoring requirement.
 - .10 Safety and environmental considerations.
 - .11 Sequence of events through the course of the Cx Phase.
 - .12 Schedule.
 - .13 Risk register.
 - .14 Shutdown/tie-in work plans.
 - .15 Emergency response plans.
 - .16 Contingency plans to respond to potential emergencies, such as major equipment failures or instrumentation and control problems.
 - .17 Schedule of deferred Cx activities (including post-occupancy, seasonal and other deferred testing).
 - .18 Requirements for pre-start-up, including the processes for performance of activities, confirmation and documentation.
 - .19 Requirements for start-up, including the processes for performance of activities, confirmation and documentation.
 - .20 Requirements for FPT, including the processes for performance of activities, confirmation and documentation.
 - .21 Requirements for system verification, including the processes for performance of activities, confirmation and documentation.
 - .22 Record-keeping procedures for identifying deficiencies (including resolution and status) and for equipment status.

- .23 Training.
- .24 Final acceptance.

1.4 QUALITY CONTROL

- .1 When specified in individual Sections of Contract Documents, require Manufacturer or Supplier to provide authorized representative(s).
- .2 Calibration:
 - .1 Calibrate all test equipment to $\pm 2\%$ of actual value at full scale.
 - .2 Employ recognized, industry standard calibration procedures or as specified in individual Sections.
 - .3 Submit calibration plans and results to Engineer.

1.5 DOCUMENT CONTROL

- .1 The Contractor shall be responsible for document control.

1.6 SAFETY

- .1 Ensure all requisite safety equipment, devices, detectors, materials, and procedures are in place, tested and operational before commencing.
- .2 Conform to requirements of all regulatory authorities having jurisdiction.
- .3 Maintain communications with fire, police, environmental and health authorities.

1.7 ENVIRONMENTAL PROTECTION

- .1 Comply with all requirements of federal, provincial, and local jurisdictions having authority.

1.8 DEMONSTRATION AND TRAINING

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to the Owner's personnel prior to system verification.
- .2 The Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.
- .3 When specified in individual Sections, require Manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct the Owner's personnel and provide written report that demonstration and instructions have been completed.
- .4 Submittals:
 - .1 Submit schedule of time and date for demonstration of each item of equipment and each system 3-weeks prior to designated dates for the Engineer and the Owner's approval.
 - .2 Submit reports within 1-week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

- .5 Conditions for demonstrations:
 - .1 Equipment has been inspected and undergone FPT.
 - .2 Testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
 - .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.
- .6 Scope of training:
 - .1 Training must be conducted by qualified Manufacturer's representatives, vendors, installation/service technicians and operation personnel having the necessary knowledge, experience, and teaching skills.
 - .2 The training shall provide comprehensive instruction on the operation and maintenance of building components, equipment, controls, and systems including procedures for start-up, shutdown, normal operation, abnormal operation, preventive maintenance, troubleshooting, and corrective maintenance.
 - .3 Each training session shall at a minimum cover the following items as applicable:
 - .1 Walk-down of covered equipment and systems.
 - .2 Demonstration of start-up, shutdown, and operating procedures.
 - .3 Demonstration of diagnostic, service, maintenance and repair procedures.
 - .4 Emergency shutdown procedures.
 - .5 Locations of critical isolation valves.
 - .4 Follow-up or post-occupancy training, where specified, shall be planned, scheduled, and conducted per the requirements of this specification. This training will focus on seasonal issues that could not be addressed during the initial training and on addressing operational and maintenance issues identified by the Owner since turnover.

1.9 Cx REPORT

- .1 Upon completion of system verification, the Contractor shall submit a Cx Report in digital PDF format.
- .2 The Contractor shall prepare the Cx Report to include all Cx Program documentation.

Part 2 Products

- .1 Not used.

Part 3 Execution

3.1 PRE-START-UP

- .1 Prepare Pre-start-up Equipment Checkout Listing which includes all Process Mechanical, Commodity-retaining Structures, Building Mechanical, Instrumentation and Controls and Electrical Equipment. Group listing into logical systems or sub-systems for orderly progression of activities during start-up.
- .2 Identify all pieces of equipment by tag numbers.
- .3 To extent practical, remove all scaffolding, debris, planks tools and other construction-related material.
- .4 Remove all sand, silt, dirt and debris from tanks, channels, chambers, instrumentation and control panels and electrical panels and vacuum clean.
- .5 Clean all surfaces of tanks and conduits, including walls, roofs, floors and columns with high pressure water jets or as specified in individual Sections.
- .6 Clean interior of all pipes and fluid-carrying equipment, including pumps and inspect with Engineer present.
- .7 Conduct leakage and pressure tests in accordance with individual Sections.
- .8 Conduct disinfection procedures in accordance with requirements of individual Sections.
- .9 Provide checkout tags for each piece of equipment.
- .10 Equipment Manufacturer's representatives to inspect equipment in accordance with applicable individual Sections. Certify equipment has been properly installed and is ready to start.
- .11 Equipment checkout listing:
 - .1 The Contractor shall develop and update the Equipment Checkout Listing (ECL) using Microsoft Excel.
 - .2 ECLs consist of a series of field observations and verification checks conducted by the Contractor during the installation of commissioned equipment to verify the following:
 - .1 Installed equipment matches the specifications and approved submittals.
 - .2 Equipment is installed per the Specifications, Drawings, and Manufacturer's recommendations.
 - .3 Connections to equipment, such as electrical, steam, chilled water, etc. have been successfully completed.
 - .4 Equipment is ready for start-up per Manufacturer's guidelines.

- .3 Contractors should expect to complete one ECL for each piece of equipment covered by the commissioning process such as pumps, fans, air handling units, terminal units, control panels, lighting control panels, etc. Each ECL is to be completed by each applicable trade verifying that all appropriate checks have been made, including but not limited to, cleaning, inspection, leakage testing, lubrication, rotation, calibration, adjustment, and wire loop checks.
- .4 ECLs for mechanical equipment will include verification of the safety devices intended to stop and/or prevent equipment operation unless minimum safety standards or conditions are met. These may include adequate oil pressure, proof-of-flow, non-freezing conditions, maximum static pressure, maximum head pressure, etc. The Contractor shall observe the actual performance of safety shutoffs in a real or closely simulated condition of failure.
- .5 Systems may include safety devices and components that control a variety of equipment operating as a system. Interlocks may be hard-wired or operate from software. Operation of these interlocks shall be verified by the Contractor.
- .6 Additional checklists will be required to verify installation of distribution systems such as piping, ductwork, electrical wire, and conduit, etc. The number of required ECLs will vary from system to system but will typically be limited to one form per system per floor or zone.
- .7 ECLs shall be submitted to the Engineer for review and include the following:
 - .1 System description.
 - .2 Equipment name and tag number of each component within system.
 - .3 Supplier's name of each equipment component, complete with sign-off where applicable.
 - .4 Mechanical trade sign-off.
 - .5 Electrical/instrumentation trades sign-off.
 - .6 Contractor sign-off.
- .8 Append the following to ECLs:
 - .1 Manufacturer's Representatives' Installation Certification Form.
 - .2 Hydrostatic Test Certification Forms for Process Tanks.
 - .3 Pressure Test Certification Forms for Process Tanks.
 - .4 Disinfection Certification Forms where applicable.
 - .5 Instrumentation and Electrical Equipment Loop Check Forms.
 - .6 Instrumentation Calibration Forms.
 - .7 Listing of outstanding contract deficiencies for each system.
- .12 Request, in writing, a pre-start-up inspection by Engineer. Once Engineer has conducted the pre-start-up inspection and is satisfied that each piece of equipment has been properly checked-out, submit a completed Equipment Installation Certification Form (refer to Appendix C) for each piece of equipment in the system.

3.2 START-UP

- .1 Conduct workshop(s) with Cx Team to identify and integrate activities of all parties in start-up of Work. Review the sections of the CxP pertaining to start-up.

- .2 Develop Owner training plan and implement.
- .3 Provide Operating and Maintenance Manuals as required by individual Sections.
- .4 The Contractor shall conduct all startup testing as required by the specifications, equipment Manufacturer, the Manufacturer's installation, operations and maintenance manual or as necessary to verify all equipment is properly installed.
 - .1 Conduct Dry Run Tests for all equipment, witnessed by Engineer.
 - .2 Conduct Wet Run Tests for all equipment, witnessed by Engineer.
 - .3 Correct any deficiencies uncovered during testing.
- .5 Startup testing shall be documented. Appropriate documentation shall be prepared by the Contractor and/or the Manufacturer's representative. The startup testing shall be documented using the Contractors or Manufacturer's standard forms electronic PDF copies shall be submitted to the Engineer for review.
- .6 Once all system components have been started to the satisfaction of the Engineer, a Start-up Certification Form (refer to Appendix C) shall be prepared for each component by the Contractor certifying the component is complete, successfully tested, started and ready for FPT.

3.3 FPT PROCEDURES

- .1 Once Start-up Certification Forms have been completed for each component within a system, FPT for that individual system shall be commenced. The Contractor shall conduct, at a minimum, FPT procedures appended to the Contract Documents. FPT shall be completed in accordance with the CxP and under the witness of the Engineer and/or Owner.
- .2 Commencement of FPT Procedures shall require the following conditions be satisfied:
 - .1 Pre-start-up and start-up checks have been completed to allow safe, automatic operation of each piece of equipment within all systems either directly or indirectly under test.
 - .2 Sequence of Operation Plans, as described below, have been approved by the Engineer and Owner.
 - .3 An FPT Schedule, as described below, has been approved by the Engineer and Owner.
- .3 In all cases where FPT cannot be performed off-line, the requirements for on-line operation, set forth in section below on System Verification, shall apply.
- .4 FPT procedures:
 - .1 The Contractor shall prepare FPT Procedures to verify all equipment and systems operate in accordance with the Process Control Narrative, including all described failure scenarios.
 - .1 Each FPT Procedure shall indicate the description and order of events which are required to simulate a failure. During testing, the system is expected to respond as indicated. Any deviation from the expected outcomes shall be reported to the Engineer.

- .2 Except as stated, all equipment should be in the Auto position, in a healthy, available condition and operating normally prior to carrying out each group of test procedures. The PLC shall be in Program mode.
 - .3 The FPT Procedures shall list the HMI banner alarms that are intended be caused directly by the applicable test operation. Alarms that remain from previous test operations should not be carried forward to ensure it is clear what alarms are pertinent to each specific test.
- .2 FPT Procedures shall be submitted to the Engineer for review a minimum of 4-weeks in advance of commencement of FPT.
- .3 Provide all required testing equipment and ancillary equipment to verify specified performance.
- .5 FPT procedure configuration:
 - .1 Each FPT Procedure indicates the description and order of events which are designed to simulate a failure. The pump station is expected to respond as indicated. Any deviation from the expected outcomes shall be reported to the Engineer.
 - .2 Except as stated, all pump station equipment should be in the Auto position, in a healthy, available condition and operating normally prior to carrying out each group of tests. The PLC shall be in Program mode.
 - .3 The listed HMI banner alarms are intended to show the alarms that are caused directly by the applicable test operation. Alarms that remain from previous test operations are not carried forward to ensure it is clear what alarms are pertinent to each specific test.
- .6 Sequence of operation plans:
 - .1 The Contractor remains fully responsible for coordination, witnessing and safe operation of FPT. The Contractor shall develop and submit to the Engineer an appropriate test plan to describe the operational sequences that will be employed to achieve each test configuration.
 - .2 The Contractor shall also submit a figure of test arrangements for each testing phase to identify the overall system configuration. These figures are intended to outline required status for the equipment involved, including valves, breakers, disconnects, etc.
- .7 FPT schedule:
 - .1 A minimum of 4-weeks prior to the commencement of FPT the Contractor shall develop and submit to the Engineer a Gantt Chart style schedule to indicate the proposed sequencing of FPT Procedures. The FPT schedule shall reference the proposed dates for performance of all FPT Procedures with respect to the corresponding Sequence of Operations Plans.
 - .2 At any point throughout FPT the Engineer or Owner shall have the right to immediately stop or suspend FPT procedures if the testing activities are or are anticipated to adversely impact in-operation systems. Continuous operation of existing connected infrastructure maintains primary precedence over FPT. Should the Owner stop or suspend FPT to safeguard operations, the Contractor shall not be permitted to make claims for delay.

- .8 FPT procedure execution:
 - .1 All FPT procedures shall be completed by the Contractor and witnessed by the Contractor and Engineer and/or Owner. As the procedure is performed, the Contractor shall acknowledge completion of each step and document discrepancies between actual outcomes and anticipated outcomes. Upon completion of a procedure, the Contractor and Witness shall sign each completed form. Each completed form shall be reviewed and signed by the Contractor. The completed and signed forms shall be submitted to the Engineer for review. Should any actual outcomes which deviate from anticipated outcomes be deemed by the Contractor or Engineer to not comply with the Contract Requirements, including that described within the Process Control Narrative, the Contractor shall make the necessary repairs/modifications and reperform the procedure at no additional cost to the Owner.
- .9 The Contractor shall be responsible for the correction and retesting of all deficiencies uncovered through conductance of FPT Procedures.
- .10 Once all FTP procedures have been performed to the satisfaction of the Engineer, prepare, and submit a Functional Performance Testing Certification Form (refer to Appendix C) certifying that the system is complete, successfully tested and ready for System Verification.

3.4 SYSTEM VERIFICATION

- .1 System verification shall only be permitted to commence once the following conditions have been met:
 - .1 The respective system FPT Certification Forms have been approved by the Engineer.
 - .2 Owner training has been completed to the acceptance of the Owner.
 - .3 O&M manuals have been approved by the Engineer.
 - .4 The Owner has confirmed that all operating permits and other regulatory requirements are secured.
 - .5 The Owner has confirmed that the systems proposed to undergo system verification will not inevitably disrupt the operation of existing in-production systems.
- .2 The facility, or each system within the facility, will be brought on-line for continuous operation during system verification, first in manual mode and then in automatic mode under the control of the facilities SCADA system or PLCs.
- .3 In the case of potable water facilities, conduct all chemical and bacteriological analyses required to establish conformance with water quality standards and notify all health officials and regulatory authorities before discharging water to the receiving system.

- .4 System verification period:
 - .1 Period for continuous automatic operation for System Verification is 7-consecutive-calendar-days with all systems operating continuously without fault and all process, mechanical, control and electrical equipment free of vibration, overloading or overheating and functioning in accordance with specified rates, methods and performance.
- .5 The Contractor's Cx Team may be required to be at site outside of normal working hours during the System Verification Period, at the discretion of the Owner or Engineer and shall be available within 4-hour notice.
- .6 Remove and clean or replace as required all permanent and temporary filters and strainers in pipeline systems; replace HVAC filters; dewater and clean sumps and leave process systems clean and filled with clean water, unless otherwise directed by Engineer.
- .7 Failure of any part of Work during the System Verification Period will require restart of that portion or system of Work, following rectification of the fault or failure. If it is necessary to suspend System Verification during the period of continuous operation due to deficiencies or failure in any system, the full cost of interruption, callback, testing and resumption of start-up, FPT and/or system shall be paid by the Contractor.
- .8 Upon System Verification having been performed to the satisfaction of the Engineer, prepare, and submit a System Verification Certification Form (refer to Appendix C) certifying that the system is fully tested and ready for turnover.

END OF SECTION

Part 1 General

1.1 MANUAL

- .1 An organized compilation of operating and maintenance data including detailed technical information, documents and Records describing operation and maintenance of individual products or systems as specified in individual sections of Divisions 02 to 49.

1.2 GENERAL

- .1 Prepare two copies of documentation including as-constructed Shop Drawings to instruct Owner's operations and maintenance staff in the operation and associated maintenance of each piece of equipment and system as supplied and installed.
- .2 Submit a skeleton of the O & M Manual, including table of contents, section tabs, scale mock-up of printing proposed for the binders and sample of proposed record drawing storage mechanism, to Engineer for approval before 60% of the Work is approved for payment. No payment over 60% of the Contract value will be made until this is received.
- .3 Submit the completed O & M Manuals before 90% of the Work is approved for payment. No payment for any Work will be made over 90% of the Contract value until completed O & M Manuals are received and accepted as satisfactory.

1.3 BINDERS

- .1 Provide the material in 80 mm or 135 mm spine, 215 × 280 mm capacity extension type black catalogue binders bound in heavyweight fabriccord with gold lettering on front and spine. The binders are to be Oxford® Catalog Binder with Expanding Posts, Model: OXFC619-3, or Van Bind Canada Expandable Binder, or Barlock expandable binders by Vancouver Bookbinding Ltd. (604) 872-8132 or 1-800-670-2463 or approved alternative.

1.4 CONTENTS

- .1 Arrange the material in volumes as described below. Provide a separate binder for each volume unless directed otherwise by Engineer. Where more than one binder is required to accommodate the documentation for a volume, increase or decrease the number of volumes and renumber as necessary.
Volume 1 - Operating Manual
Volume 2 - Architectural/Structural
Volume 3 - Mechanical Operations and Maintenance
Volume 4 - Electrical and Instrumentation Operations
- .2 Permanently number each set.
- .3 Letter the spine of the binder with the full identification title of the project and the front face with the following on the respective binders:
Full identification title of the project
Volume number
Volume title

- Owner's name, e.g., (Town of Outlook)
Number of sets (e.g., 1 of 3)
- .4 Engineer will prepare the manual content in Volume 1. All other Volumes are the responsibility of Contractor. Provide the binders and the dividing tabs to Engineer for the compilation of Volume 1.
- .5 Arrange the binders according to the Construction Specifications Institute MASTERFORMAT - Master List of Sections, Titles and Numbers, utilizing laminated mylar plastic divider tabs, colour coded according to section. Markings on the tabs are to be type written. Tab colours are to be as follows:
- .1 Division - white.
.2 Sections - orange.
.3 Subsections - yellow.
- .6 Make up each binder as follows:
- .1 Tab: Table of Contents - Details the titles of various divisions of the manual in the binder.
.2 Tab: Introduction to Manual - Written explanation of the layout of the manual and intended use.
- .7 Include separately the following:
- .1 Consultant: Name, address, telephone, email contact address, and name of Project Manager.
.2 Contractor: Name, address, telephone, email contact address, and name of Project Manager.
.3 Major Subcontractors: Name, address, telephone, and email contact address of Subcontractors included in that binder.
- .8 Provide the following for each respective discipline:
- .1 Tab: Division Number xx.
.2 Index: information in that division in order of appearance in the specification.
.3 List of Subcontractors and Suppliers: name, address, and telephone and email contact address.
.4 Specification Section cross reference.
.5 Drawing list.
- .9 Organize the various applicable sections under separate divider tabs labelled division/number as required by the project. A typical outline is as follows:
- Tab: DIVISION 7 - THERMAL AND MOISTURE PROTECTION**
07 11 13 - Bituminous Dampproofing
07 16 19 - Metal Oxide Waterproofing
07 18 00 - Traffic Coatings
07 19 00 - Water Repellents
07 21 13 - Board Insulation
07 21 16 - Blanket Insulation
07 21 23 - Loose-Fill Insulation
07 24 00 - Exterior Insulation and Finish Systems
07 26 00 - Vapour Retarders

- 07 31 29 - Wood Shingles and Shakes
- 07 61 00 - Sheet Metal Roofing
- 07 62 00 - Sheet Metal Flashing and Trim
- 07 72 33 - Roof Hatches
- 07 92 00 - Joint Sealing

.10 Provide the information given below, where applicable, for each system and major piece of equipment. Refer to each piece of equipment by its name and tag number. Where manufacturer's literature covers several models or options, highlight the applicable information, using a non-fading marker, and cross out redundant information.

- .1 Index of information in that section in order of appearance;
- .2 Description of system, components and technical data. Include interfaces, sequences, operations; characteristic changes for seasonal operation;
- .3 Maintenance and operating instructions including:
 - .1 Installation instructions.
 - .2 Procedure for starting.
 - .3 Proper adjustment.
 - .4 Test procedures.
 - .5 Procedure for operating.
 - .6 Procedure for shutdown.
 - .7 Safety precautions.
 - .8 List of electrical relay settings and control and alarm contact settings.
- .4 Troubleshooting data;
- .5 Preventative maintenance program complete with:
 - .1 Suggested check list sheets.
 - .2 List of points to be greased or oiled.
 - .3 Recommended type, grade and temperature range of lubricants.
 - .4 List of wear points to be inspected and/or adjusted regularly.
 - .5 Suggested schedule for lubrication and inspection.
- .6 Schematic, single line, and wiring diagrams;
- .7 Valve tag list;
- .8 Recommended spare parts list;
- .9 Certification, guarantee, warranty;
- .10 Service representatives - name, address and telephone number;
- .11 Suppliers for replacement parts - name, address, and telephone numbers;
- .12 Test results; witness testing and commissioning, reports;
- .13 Test data for piping systems (degreasing, flushing, disinfection);
- .14 Hydrostatic or air tests performance;
- .15 Equipment alignment certificates;
- .16 Balancing data for air and water systems; and
- .17 Inspection approval certificates for all types of systems; plumbing and piping, hot air and ventilating, electrical supervisory, etc.

- .11 The material submitted in accordance with the Contractual requirements for "As-Constructed Shop Drawings" is generally bulky and difficult to file in a binder. If requested by Engineer, provide copies of all "As-Constructed Shop Drawing" material in a single drawer legal size cardboard file cabinet. Arrange in accordance with the Construction Specifications Canada MASTERFORMAT. Identify any material located in the file cabinet as such in the appropriate location in the binders.
- .12 At Engineer's discretion, provide the information in plastic map pockets in appropriate sections in the binders.

Part 2 **Products**
Not used.

Part 3 **Execution**
Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes the following:
 - .1 Demolition and removal of selected portions of exterior building components or structural elements.
 - .2 Repair procedures for selective demolition operations.
- .2 This section does not include the following:
 - .1 Removal of hazardous materials or asbestos abatement.
 - .2 Demolition of interior building components and finishes.
- .3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 19.16 - Selective Interiors Demolition.

1.3 REFERENCE STANDARDS

- .1 All standards and coders to latest edition.
- .2 American National Standards Institute (ANSI):
 - .1 ANSI A10.8 2011, Safety Requirements for Scaffolding
- .3 CSA Group:
 - .1 CSA S350 M1980 R2003, Code of Practice for Safety in Demolition of Structures
- .4 National Research Council Canada (NRC):
 - .1 National Building Code of Canada (NBC).
- .5 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Assessment Act (CEAA).
 - .2 Canadian Environmental Protection Act (CEPA):
 - .1 SOR, On-Road Vehicle and Engine Emission Regulations.
 - .2 SOR-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), c. 34.
 - .4 Motor Vehicle Safety Act (MVSA).
 - .5 Hazardous Materials Information Review Act.

- .6 National Fire Protection Association (NFPA):
 - .1 NFPA 241 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.4 DEFINITIONS

- .1 Demolish: detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Remove and salvage: detach items from existing construction and ready for reuse.
- .3 Remove and reinstall: detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to remain: existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.
- .5 Hazardous substances: dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.
- .2 Coordination: coordinate with Engineer for the material ownership as follows:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- .3 Pre-demolition meeting: conduct a pre-demolition meeting at Project site in accordance with requirements listed in Division 01 to confirm extent of salvaged and demolished materials; and to review Contractor's demolition and entry plan prepared by a professional engineer.

1.6 ACTION AND INFORMATION SUBMITTALS

- .1 Action submittals: provide the following submittals before starting any work of this Section:
 - .1 Schedule of selective demolition activities: coordinate with Division 01, and indicate the following:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - .2 Coordinate with Owner's ongoing site operations and limit the number of interruptions during regular business hours.
 - .3 Interruption of utility services.
 - .4 Coordination for shutoff, capping, and continuation of utility services.

- .5 Use of elevator and stairs.
- .6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
- .7 Coordination with Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- .2 Entry plan: due to the excessive deterioration of the steel platforms. An entry plan prepared by and signed and sealed by an engineer registered in the province of Saskatchewan is to be submitted for review and approval prior to any personnel entry into the Raw Water Pump House.
- .3 Demolition plan: submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer and signed and sealed in the province of Saskatchewan, and as follows:
 - .1 Proposed dust control measures: submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Engineer reserves the right to make modifications where proposed methods interfere with the Owner's ongoing operation
 - .2 Inventory: submit a list of items that have been removed and salvaged after selective demolition is complete.
 - .3 Landfill records: indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - .4 Pre-demolition videotape and photographs: submit photographs/videotape indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.
- .2 Informational submittals: provide the following submittals when requested by the Engineer:
 - .1 Qualification data: submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of architects and owners, for work of similar complexity and extent.

1.7 QUALITY ASSURANCE

- .1 Regulatory requirements: comply with governing environmental notification requirements and regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction and in accordance with the following:
 - .1 Saskatchewan Workers' Compensation Boards.
 - .2 Saskatchewan Occupational Health and Safety Act and Standards.
- .2 Demolition firm qualifications: an experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:

- .1 Conform to the Saskatchewan Occupational Health and Safety Act and Regulations.
- .2 Conform to Saskatchewan Workers' Compensation Board Regulations.
- .3 Conform to the local municipal bylaws and regulations governing this type of work.

1.8 SITE CONDITIONS

- .1 Owner will occupy portions of building immediately adjacent to selective demolition area:
 - .1 Conduct selective demolition so that Owner's operations will not be disrupted.
 - .2 Provide not less than 72-hours notice to Owner of activities that will affect Owner's operations.
- .2 Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities and as follows:
 - .1 Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- .3 Discovery of hazardous substances: it is not expected that Hazardous Substances will be encountered in the Work; immediately notify Engineer if materials suspected of containing hazardous substances are encountered and perform the following activities:
 - .1 Refer to Division 01 for directives associated with specific material types.
 - .2 Hazardous materials will be as defined in the Hazardous Materials Act.
 - .3 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer.

Part 2 Products

2.1 MATERIALS

- .1 Temporary support structures: design temporary support structures required for demolition work and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in province of the Work.
- .2 Repair materials: use repair materials identical to existing materials:
 - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - .2 Use materials whose installed performance equal or surpasses that of existing materials.
 - .3 Comply with material and installation requirements specified in individual technical specification Sections.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that utilities have been disconnected and capped.
- .2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .4 Notify the Engineer where existing mechanical, electrical, or structural elements conflict with intended function or design:
 - .1 Investigate and measure the nature and extent of conflict and submit a written report to Engineer.
 - .2 Engineer will issue additional instructions or revise drawings as required to correct conflict.
- .5 Engage a professional engineer to survey condition of building when removing elements that may result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- .6 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- .1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations in accordance with Division 01.
- .2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished:
 - .1 Arrange to shut off affected utilities with utility companies.
 - .2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - .4 Cut off pipe or conduit to a minimum of 25 mm below slab and remove concrete mound.
- .3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.
- .4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- .1 Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

- .2 Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities:
 - .1 Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 - .2 Protect existing site improvements, appurtenances, and landscaping to remain.
- .3 Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain in accordance with Division 01, and as follows:
 - .1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - .2 Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - .3 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - .4 Cover and protect furniture, furnishings, and equipment that have not been removed.
- .4 Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities in accordance with Division 01:
 - .1 Provide temporary weather tight enclosure for building exterior.
 - .2 Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures.
 - .3 Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- .5 Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise in accordance with Division 01
- .6 Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished:
 - .1 Strengthen or add new supports when required during progress of selective demolition.
 - .2 Temporary shoring to be signed and sealed by an Engineer licensed in the province of Saskatchewan, Canada.

3.4 POLLUTION CONTROLS

- .1 Dust control: provide water mist, temporary enclosures or other suitable methods reviewed and accepted by the Engineer to limit spread of dust and dirt. Comply with governing environmental protection regulations, and as limited below:

- .1 Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- .2 Wet mop floors to eliminate tracking of dirt, wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- .2 Remove and transport debris to prevent spillage on adjacent surfaces and areas.
- .3 Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- .4 Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

- .1 Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - .1 Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - .2 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - .3 Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - .4 Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain fire watch and portable fire suppression devices during flame cutting operations.
 - .5 Maintain adequate ventilation when using cutting torches.
 - .6 Remove decayed, vermin infested, or otherwise dangerous or unsuitable materials and promptly dispose of off site.
 - .7 Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - .8 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - .9 Dispose of demolished items and materials promptly.
 - .10 Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- .2 Comply with Owner's requirements for using and protecting walkways, building entries, and other building facilities during selective demolition operations.
- .3 Removed and salvaged items:
 - .1 Clean salvaged items.

- .2 Pack or crate items after cleaning.
- .3 Identify contents of containers.
- .4 Store items in a secure area until delivery to Owner.
- .5 Transport items to Owner's storage area on site designated by Owner.
- .6 Protect items from damage during transport and storage.
- .4 Removed and reinstalled items:
 - .1 Clean and repair items to functional condition adequate for intended re use. Paint equipment to match new equipment.
 - .2 Pack or crate items after cleaning and repairing.
 - .3 Identify contents of containers.
 - .4 Protect items from damage during transport and storage.
 - .5 Reinstall items in locations indicated.
 - .6 Comply with installation requirements for new materials and equipment.
 - .7 Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- .5 Existing items to remain:
 - .1 Protect construction indicated to remain against damage and soiling during selective demolition.
 - .2 Items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- .6 Concrete: refer to drawings as indicated.
- .7 Roofing:
 - .1 Remove existing roof provided an approved protection plan has been submitted for review to the Engineer.
 - .2 Provide proper heating and hoarding to the building.
 - .3 Protection existing equipment from damage and weather.
 - .4 Protect existing building finish from damage and weather.

3.6 CLOSEOUT ACTIVITIES

- .1 Patching and repairs: promptly repair damage to adjacent construction caused by selective demolition operations and as follows:
 - .1 Patch to produce surfaces suitable for new materials where repairs to existing surfaces are required,
 - .2 Completely fill holes and depressions in remaining existing masonry walls remain with an approved masonry patching material applied according to manufacturer's written recommendations.
 - .3 Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

- .2 Demolition waste disposal: arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) except where explicitly noted otherwise for materials being salvaged for reuse in new construction where indicated on the drawings and as follows:
 - .1 Promptly dispose of demolished materials.
 - .2 Do not allow demolished materials to accumulate onsite.
 - .3 Do not burn demolished materials.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes the following:
 - .1 Demolition and removal of selected portions of interior building components and finishes.
 - .2 Repair procedures for selective demolition operations.
- .2 This Section does not include the following:
 - .1 Removal of hazardous materials or asbestos abatement.
 - .2 Demolition of exterior building components or structural elements.
 - .3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.
- .3 Drawings contain details that suggest directions for solving some of the major demolition and removal requirements for this project; Contractor is required to develop these details further by submitting a demolition plan prepared by a professional engineer employed by the Contractor.

1.2 REFERENCE STANDARDS

- .1 All standards to be to the latest edition.
- .2 American National Standards Institute (ANSI):
 - .1 ANSI A10.8 2011, Safety Requirements for Scaffolding.
- .3 CSA Group (CSA):
 - .1 CSA S350 M1980, Code of Practice for Safety in Demolition of Structures.
- .4 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Assessment Act (CEAA), 2012.
 - .2 Canadian Environmental Protection Act (CEPA), 2012:
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
 - .4 Motor Vehicle Safety Act (MVSA), 1995.
 - .5 Hazardous Materials Information Review Act, 1985.
- .5 National Fire Protection Association (NFPA):
 - .1 NFPA 241 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.3 DEFINITIONS

- .1 Demolish: detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

- .2 Remove and salvage: detach items from existing construction and deliver them to ready for reuse.
- .3 Remove and reinstall: detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to remain: existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.
- .5 Hazardous substances: dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: coordinate with Owner for the material ownership as follows:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
 - .2 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

1.5 ACTION AND INFORMATION SUBMITTALS

- .1 Action submittals: provide the following submittals before starting any work of this Section:
 - .1 Schedule of selective demolition activities: coordinate with Division 01, and indicate the following:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - .2 Coordinate with Owner's operator of ongoing site operations.
 - .3 Interruption of utility services.
 - .4 Coordination for shutoff, capping, and continuation of utility services.
 - .5 Use of elevator and stairs.
 - .6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
 - .7 Coordination with Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - .2 Entry plan: due to the excessive deterioration of the steel platforms. An entry plan prepared by and signed and sealed by an engineer registered in the province of Saskatchewan is to be submitted for review and approval prior to any personnel entry into the Raw Water Pump House.

- .3 Demolition plan: submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer and signed and sealed in the province of Saskatchewan, and as follows:
 - .1 Proposed dust control measures: submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Engineer reserves the right to make modifications where proposed methods interfere with the Owner's ongoing operation
 - .2 Inventory: submit a list of items that have been removed and salvaged after selective demolition is complete.
 - .3 Landfill records: indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - .4 Pre-demolition videotape and photographs: submit photographs and videotape indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.
- .2 Informational submittals: provide the following submittals when requested by the Engineer:
 - .1 Qualification data: submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of owners, for work of similar complexity and extent.

1.6 QUALITY ASSURANCE

- .1 Regulatory requirements: perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:
 - .1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.
 - .2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.
- .2 Qualifications: provide proof of qualifications when requested by Engineer:
 - .1 Demolition firm qualifications: an experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:
 - .1 Conform to the provincial Occupational Health and Safety Act and Regulation.
 - .2 Conform to Workers' Compensation Board Regulations.
 - .3 Conform to Town of Outlook bylaws and regulations governing this type of work.

1.7 SITE CONDITIONS

- .1 Owner will occupy portions of building immediately adjacent to selective demolition area:
 - .1 Conduct selective demolition so that Owner's operations will not be disrupted.
 - .2 Provide not less than 72-hours notice to Owner of activities that will affect Owner's operations.
- .2 Maintain access to existing means of egress, walkways, corridors, exits, and other adjacent occupied or used facilities in accordance with Division 01:
 - .1 Do not close or obstruct means of egress, walkways, corridors, exits, or other occupied or used facilities without written acceptance from authorities having jurisdiction.
- .3 Discovery of hazardous substances: it is not expected that Hazardous Substances will be encountered in the Work; immediately notify Engineer if materials suspected of containing hazardous substances are encountered and perform the following activities:
 - .1 Refer to Division 01 for directives associated with specific material types.
 - .2 Hazardous materials will be as defined in the Hazardous Materials Act.
 - .3 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer.

Part 2 Products

2.1 TEMPORARY SUPPORT STRUCTURES

- .1 Design temporary support structures required for demolition work and underpinning and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in province of the Work.

2.2 DESCRIPTION

- .1 This section of the Work includes, but is not necessarily limited to, the following:
 - .1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris.
 - .2 Selective demolition to allow new platform, walls, roofs, ceilings and other materials to meet existing construction as indicated.
 - .3 All material from demolition shall be removed from site immediately with no salvage, selling, sorting or burning permitted on site.
 - .4 Retain items indicated on drawings for reuse in new construction.

2.3 DEBRIS

- .1 Make all arrangements for transport and disposal of all demolished materials from the site.

2.4 EQUIPMENT

- .1 Provide all equipment required for safe and proper demolition of the building interiors indicated.

2.5 REPAIR MATERIALS

- .1 Use repair materials identical to existing materials:
 - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - .2 Use a material whose installed performance equals or surpasses that of existing material.
 - .3 Comply with material and installation requirements specified in individual Specification Sections.
- .2 Concrete unit masonry: lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.
- .3 Prefinished sheet steel: prefinished sheet steel, colour to match existing.
- .4 Hoarding and dust screens: refer to Division 01 for stud framing and gypsum board sheathing materials.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that utilities have been disconnected and capped.
- .2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .4 Notify the Engineer where existing mechanical, electrical, or structural elements conflict with intended function or design:
 - .1 Investigate and measure the nature and extent of conflict and submit a written report to Engineer.
 - .2 Engineer will issue additional instructions or revise drawings as required to correct conflict.
- .5 Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.2 PREPARATION

- .1 Identify and mark all equipment and materials identified to be retained by Owner or to be re used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.

- .2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.
- .3 Confirm that all electrical and telephone service lines entering buildings are not disconnected.
- .4 Do not disrupt active or energized utilities crossing the demolition site.
- .5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.
- .6 Mark all materials required to be re used, store in a safe place until ready for reinstallation.
- .7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.
- .8 Remove permanent marker lines used or found on exposed surfaces and at surfaces indicated for subsequent finish materials. Mechanically remove permanent marker lines and associated substrates where permanent marker lines occur and patch surface. Sealing or priming over permanent marker lines is not acceptable.

3.3 SELECTIVE DEMOLITION

- .1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.
- .2 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.
- .3 Demolish in a manner to minimize dusting and to prevent migration of dust.
- .4 Selling or burning of materials on the site is not permitted.
- .5 Complete concrete repairs by cutting and chipping, take precautions against wall cracking and degradation. Repair in accordance with Division 03.
- .6 Fill all openings in wood plank walls with new wood planks and necessary backing to match existing, finish to repair area to match existing.
- .7 Remove existing louvre grill and properly flash and seal the exterior to match existing finish.
- .8 Demolish existing main floor platform and intermediate platform to allow for new construction as indicated on Drawings:
 - .1 Demolish existing platforms including structural steel, grating, angles, bolts, anchors, remove and dispose off of site.
- .9 Demolish existing roof as indicated.
- .10 Demolish rebar ladder rungs and dispose of off site. Existing ladder to remain.
- .11 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.
- .12 Patch and repair all mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.4 PATCHING AND REPAIRING

- .1 Floors and walls:
 - .1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
 - .2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
 - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
 - .4 Patch with durable seams that are as invisible as possible.
 - .5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - .6 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- .2 Ceilings: patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.5 PROTECTION

- .1 Prevent debris from blocking drainage inlets and systems and ground draining and protect material and electrical systems and services that must remain in operation.
- .2 Arrange demolition and shoring work so that interference with the use of adjoining areas by the Owner and users is minimized.
- .3 Maintain safe access to and egress from occupied areas adjoining.
- .4 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.6 CLEANING

- .1 Divert excess materials from landfill to site approved by Engineer.
- .2 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.
- .3 Maintain access to exits clean and free of obstruction during removal of debris.
- .4 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights of way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.
- .5 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 All cost related to the work performed under this section will be paid by cash allowance.
- .2 Comply with requirements of this Section when performing the following Work:
 - .1 It is expected the masonry walls within the Raw Water Pump House (RWPH) may have asbestos filled insulation:
 - .1 Extents of work involving masonry is limited to drilling/anchoring.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 19.13 - Selective Building Demolition.
- .2 Section 02 41 19.16 - Selective Interior Demolition.

1.3 REFERENCE STANDARDS

- .1 All standards are to be the latest edition.
- .2 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-1.205, Sealer for Application of Asbestos Fibre Releasing Materials.
- .3 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 WHMIS Safety Data Sheets (SDS).
- .5 Transport Canada (TC):
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .6 Underwriters' Laboratories of Canada (ULC).

1.4 DEFINITIONS

- .1 Amended water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .2 Asbestos containing materials (ACMs): materials that contain provincial regulated amount per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.
- .3 Asbestos work area: area where work takes place which will or may disturb ACMs.
- .4 Authorized visitors: Engineer, or designated representative, and representative of regulatory agencies.
- .5 Competent worker: in relation to specific work, means a worker who:
 - .1 Is qualified because of knowledge, training and experience to perform the Work.

- .2 Is familiar with the federal and provincial laws and with the provisions of the regulations that apply to the Work.
- .3 Has knowledge of all potential or actual danger to health or safety in the Work.
- .6 Friable materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .7 Glove bag: prefabricated glove bag as follows:
 - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
 - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
 - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
 - .4 Straps for sealing ends around pipe.
- .8 HEPA vacuum: high efficiency particulate air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.
- .9 Non-friable material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .10 Occupied area: any area of building or work site that is outside Asbestos Work Area.
- .11 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
- .12 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Division 01.
- .2 Submit proof satisfactory to Engineer that suitable arrangements have been made to dispose of asbestos containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit to Engineer necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed.
- .6 Submit proof satisfactory to Engineer that all asbestos workers have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

- .7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than 2-days duration, approved by Engineer. Minimum of one supervisor for every ten workers.
- .8 Submit Worker's Compensation Board status and transcription of insurance.
- .9 Submit proof satisfactory to Engineer that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

1.6 QUALITY ASSURANCE

- .1 Regulatory requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.
- .2 Health and safety:
 - .1 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
 - .2 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.
 - .3 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are the responsibility of the Contractor.
 - .4 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
 - .5 Visitor protection:
 - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
 - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
 - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .3 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mils bags or leak proof drums. Label containers with appropriate warning labels.

- .4 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.8 EXISTING CONDITIONS

- .1 Reports and information pertaining to ACMS to be handled, removed, or otherwise disturbed and disposed of during this Project are not available. Masonry cores are expected to be filled with asbestos containing insulation due to the age of the building. It is the responsibility of the contractor to confirm the presence of asbestos prior to completing the Work.
- .2 Notify Engineer of friable material discovered during Work and not apparent from drawings and specifications pertaining to Work. Do not disturb such material until instructed by Engineer.

1.9 PERSONNEL TRAINING

- .1 Before beginning Work, provide Engineer satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
 - .1 Fitting of equipment.
 - .2 Inspection and maintenance of equipment.
 - .3 Disinfecting of equipment.
 - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.

Part 2 Products

2.1 MATERIALS

- .1 Drop and enclosure sheets:
 - .1 Polyethylene: 0.15 mm thick.
 - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting agent: 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos containing material.
- .3 Waste containers: contain waste in two separate containers.
 - .1 Inner container: 0.15 mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.
 - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise, outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

- .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.
- .4 Glove bag:
 - .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.
 - .2 The glove bag to be equipped with:
 - .1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
 - .2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
 - .3 A tool pouch with a drain.
 - .4 A seamless bottom and a means of sealing off the lower portion of the bag.
 - .5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
- .5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8-hours and designed for purpose of trapping residual asbestos fibres:
 - .1 Sealer: flame spread and smoke developed rating less than 50.
- .7 Encapsulant: surface film forming type conforming to CAN/CGSB-1.205 and ULC listed.

Part 3 Execution

3.1 SUPERVISION

- .1 Minimum of one Supervisor for every ten workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

- .1 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm)/NO UNAUTHORIZED ENTRY (19 mm)/WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm)/BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.
 - .2 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of Work.

- .1 Use HEPA vacuum or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.
- .2 Do not use compressed air to clean up or remove dust from any surface.
- .3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done:
 - .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.
- .4 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage:
 - .1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.
 - .2 Perform Work in a manner to reduce dust creation to lowest levels practicable.
- .5 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .6 Cleanup:
 - .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
 - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
 - .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
 - .4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.
 - .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

- .1 From beginning of Work until completion of cleaning operations, Contractor to take air samples on daily basis outside of Asbestos Work Area enclosures in accordance with Provincial/Territorial Occupational Health and Safety Regulations:
 - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

- .2 If air monitoring shows that areas outside Asbestos Work Area enclosures are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.
- .3 Ensure that respiratory safety factors are not exceeded.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section refers to concrete repair work inside the existing wet well surfaces as identified on the Contract Drawings. Concrete repair shall be performed where necessary to all surfaces including repairs on horizontal and vertical surfaces.
- .2 In the repair areas which are classified as confined spaces, the Contractor shall include all necessary equipment and resources to perform the repairs in accordance with all applicable regulations, standards and codes.

1.2 REFERENCE STANDARDS

- .1 By-Laws: Conform to the requirements of the National building code 2020 of Canada and all amendments and all local, Municipal and Provincial building by-laws and ordinances.
- .2 Conform to the latest addition of the following reference standards:
 - .1 American Concrete Institute (ACI)
 - .1 ACI 117, Standard Tolerances for Concrete Construction and Materials
 - .2 CSA Group
 - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA G30.18, Billet-Steel Bars for Concrete Reinforcing.
 - .3 International Concrete Repair Institute (ICRI)
 - .1 Technical Guideline No. 310.1R, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
 - .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 Manual of Standard Practice

1.3 DEFINITIONS

- .1 Horizontal - ALL horizontal surfaces within ± 15 degrees of the horizontal plane. This applies to the topside of the horizontal surface only.
- .2 Vertical - All vertical surfaces within ± 15 degrees of the vertical plane.

1.4 SUBMITTALS

- .1 Product data: include material descriptions, chemical composition, physical properties, test data and mixing and applications:
 - .1 Include Safety Data Sheets, if applicable.
- .2 Material test report: from a qualified testing agency indicating and interpreting test results for compliance of bonding agents, patching mortars with requirements indicated.

- .3 Repair program for each phase of the repair process, including protection of surrounding materials and project site during operations. Describe in detail the materials, methods, equipment, and sequence of operations to be used for each phase of the Work:
 - .1 If alternative materials and methods to those indicated are proposed for any phase of repair work, submit substitution request complying with Division 1 and provide a written description of proposed materials and methods, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this project.
- .4 Submit repair procedure for review by the Engineer:
 - .1 The use of power tools is prohibited.
- .5 Qualification data:
 - .1 The Subcontractors for this work needs to demonstrate previous relevant experience of this type of work and provide past project references to the Engineer.

1.5 REPAIR METHODOLOGY

- .1 The Contractor shall be responsible for mobilization/demobilization, equipment, materials, testing, labour and other items and services required to accomplish the work.

1.6 PROTECTION

- .1 Protect surrounding areas and surfaces from damage during work of this section.
- .2 Prevent precipitation and debris from entering openings and pipes.
- .3 Protect process piping and equipment from damage, dust and debris with tarps or plastic sheeting.

1.7 DELIVERY AND STORAGE

- .1 Deliver and store all repair materials in accordance with Manufacturer's instructions.
- .2 Store materials under cover on elevated platforms, stored in weather-tight buildings, bins or silos, which will exclude moisture and contaminants.
- .3 Cement shall be furnished in suitable bags used for packaging cement. Labelling of packages shall clearly define contents, Manufacturer, batch identification, etc. Reinforcing bars and accessories shall be stored in such a manner as to avoid contamination and deterioration.
- .4 Protect materials from freezing. Materials suspected of having been subjected to freezing are not to be used unless the Manufacturer verifies in writing the material has not been damaged.
- .5 Deliver and store materials in original packages with labels intact.
- .6 Remove and replace damaged, wet or broken materials.
- .7 Store materials away from open flame or ignition sources.

1.8 WARRANTY

- .1 Defective concrete repairs covered under the warranty shall include but not be limited to debonding of patches from substrate, and cracking. Replacement and repair of defective concrete repairs shall be in accordance with this section.

1.9 COORDINATION

- .1 Coordinate work under this section with work of related sections.
- .2 Contractor shall include an allowance for a sample repair area within the Northwest corner of the wet well shown on the Contract Drawings:
 - .1 Preparation and repair shall follow the repair procedure stated on the Contract Drawings.
- .3 Include an allowance in the schedule for the Engineer to inspect and document. Note that sequence of work will determine when specific areas are available for cleaning and inspection.
- .4 The Contractor shall include all resources and time required to complete all repairs as where required in the price for the repair work indicated in the Contract. Scaffolding and any other items necessary for completion of repairs should be included for all types of repairs.
- .5 Prior to commencing concrete repair preparation. The contractor is required to identify unsound concrete in the presence of the Engineer. The contractor is required to cooperate with and provide access to the Engineer.
- .6 A site visit for confirmation of the concrete preparation shall be carried out by the Engineer prior to the start of repair work. The Contractor shall provide a window of one week and proper access to allow the Engineer to perform this inspection:
 - .1 Sample area: A site visit for confirmation of the sample repair area preparation shall be carried out by the Engineer prior to the start of the repair work.
- .7 Concrete repairs will be inspected by the Engineer. The Contractor is required to cooperate with and provide access and samples to the Engineer. Contractor to test concrete in accordance with CSA-A23.2 to determine its compliance with the specification.
- .8 The bond between the existing and new grout will be evaluated in accordance with grout manufacturer's instructions.
- .9 Any work not accepted by the Engineer shall be immediately corrected by the Contractor to the Engineers satisfaction.
- .10 Cylinder testing is required. Cost of testing will be at Contractor's expense.
- .11 Post Repair Inspection
 - .1 Upon completion of the repairs, the Contractor shall immediately contact the Engineer to coordinate a site visit to inspect all repairs.

- .2 The repairs shall be inspected for cracking, crazing, delamination, unsoundness and other defects. The finish, texture and surface tolerances of the repairs shall be inspected to verify that all requirements have been met. All repair areas exhibiting defects shall be repaired as directed.
- .3 The Engineer will keep an inspection report from the Post Repair Site Inspection Visit and issue the site inspection report to Contractor and Owner to capture any deficiencies.
- .4 Deficiencies shall be addressed by the Contractor at no cost to the Owner.

1.10 EQUIPMENT

- .1 Cleaning:
 - .1 Equipment used in cleaning shall not cause staining, erosion, marring or other damage or changes in the appearance of the surfaces to be cleaned.
- .2 Sandblasting:
 - .1 Sandblasting equipment shall be used for cleaning concrete; and shall be subject to approval for each specific application.
 - .2 Sandblasting equipment shall be permitted for use in cleaning of reinforcement and other embedded metal items and concrete roughening to achieve CSP 6 in accordance with SSPC-SP13. The Contractor shall provide protective covers and barriers as required to control dust and prevent over-spray onto adjacent surfaces.
- .3 Concrete removal:
 - .1 The equipment used to remove existing deteriorated concrete shall be handheld manual.
- .4 Drilling:
 - .1 Equipment used to drill holes in concrete for patch anchors and other applications shall be standard handheld masonry drills, commonly used for drilling small holes in concrete and masonry. The drill shall be a small, powered, handheld type, using rotary drilling mode only. Impact and rotary impact type drills are prohibited.
- .5 Finishing and texturing:
 - .1 Hand tools used for placing, finishing and texturing concrete and mortar shall be commercially available and commonly used in concrete construction and repair. Equipment used for finishing and texturing concrete and mortar surfaces shall be a type commonly used in the concrete construction and repair industry for that application. Surface grinders, impact tools, and other equipment shall conform to the requirements specified herein, except as specifically required by the type of finish and texture, and subject to approval.
- .6 Compressed air supplies:
 - .1 Compressed air shall provide clean, oil and moisture free compressed air at the surface to be cleaned. The compressed air line shall have at least two in-line air filters to remove oil and moisture from the air supply. The compressed air supply shall be tested during each shift for the presence of oil and moisture.
- .7 Mixing, transporting and placing:

- .1 Equipment used for mixing, transporting, placing, and confining concrete and mortar placements shall be suitable for the intended purpose and be capable of satisfactorily mixing material, and supporting placement operations in an uninterrupted manner. Equipment shall be maintained in a clean, good operable condition at all times. Equipment used in the work shall be subject to approval. Defects, and deficiencies in operation or capacity shall be resolved prior to use in the work. Equipment used for batching, mixing, conveying and placing of materials shall be clean, free of old materials and contaminants, and shall conform to the material Manufacturer's recommendations.

Part 2 Products

- .1 Water:
 - .1 Water used in cleaning concrete surfaces, used in producing concrete and mortars, and used for curing concrete shall be potable.
- .2 Form release agents:
 - .1 Form-release agents shall be the Manufacturer's standard, nonstaining, nonpetroleum based, compatible with surface finish and subsequent surface treatments.
 - .2 Or approved alternate.
- .3 Anchor adhesives:
 - .1 HIT-HY 200-V3, adhesive for steel dowels and anchor rods/bolts, Hilti Products Inc., unless otherwise shown on the Contract Drawings.
 - .2 Minimum embedment depths as per Contract Drawings.
 - .3 Cure times and installation as per Manufacturer spec sheet.
- .4 Epoxy modified, cementitious bonding and anti-corrosion agent:
 - .1 Sika Corporation: SikaTop Armatop-110 EpoCem, or approved alternative, compatible with the repair mortar.

2.2 CONCRETE REPAIR MATERIALS

- .1 Provide non-shrink repair material for skim coats, filling bug holes and other horizontal applications less than 25 mm thickness using:
 - .1 Sika Corporation: SikaTop 122 Plus; or
 - .2 Approved equal.
- .2 Provide non-shrink repair material for formed or horizontal applications greater than 25 mm (minimum thickness varies by manufacture) using non-shrink repair mortars specified below and extended with aggregates as recommended by Manufactures:
 - .1 Sika Corporation: SikaTop 122 Plus; or
 - .1 Refer to drawings for repair notes.
 - .2 Approved equal.

- .3 Crystalline waterproofing material for crack repair:
 - .1 Xypex: Xypex Concentrate, Xypex Concentrate Dry-Pac, Xypex Patch'n Plug, NSF 61 certified; or
 - .2 Approved alternate.
- .4 Epoxy resin for crack repair:
 - .1 Epoxy to meet the requirements of ASTM C881 Type IV, Grade 1, Class B or C and have viscosity less than 500 cP;
 - .2 To be NSF 61 approved for use in potable water tanks;
 - .3 Sikadur 35 Hi-Mod LV; or
 - .4 Approved equal.

2.3 COMPATIBILITY

- .1 Ensure that all materials used are compatible. Provide written proof of compatibility.

Part 3 Execution

3.1 EVALUATION

- .1 A site visit for confirmation of the concrete deficiencies shall be carried out by the Engineer prior to the start of repair work. The Contractor shall provide a window of one week to allow the Engineer to perform this inspection.
- .2 The site visit will confirm each deficiency with regards to repair location, repair type, and repair length/area/volume.
- .3 The provisional unit prices entered in the Form of Tender should be applied. The Contractor shall alert the Engineer after preparation and prior to starting these repairs to facilitate agreement of quantity, measurement and applicable provisional unit price.
- .4 Commencement of work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the work.

3.2 PREPARATION

- .1 All formwork to be done in accordance with the following:
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA S269.1, Falsework and Formwork.
 - .3 CAN/CSA-S269.3, Concrete Formwork.

3.3 FINAL CLEANING

- .1 Refer to Division 01 for additional information pertaining to Final Cleaning Division 01.
- .2 No sooner than 72-hours after completion of the curing period and after joints are sealed, faces and other exposed surfaces of concrete shall be washed down with water applied with a soft bristle brush, then rinsed with clean water. Discolorations that cannot be

removed by these procedures will be considered defective work. Cleaning work shall be done when temperature and humidity conditions are such that surfaces dry rapidly. Adjacent surfaces shall be protected from damage during cleaning operations.

- .3 All debris and supplies shall be removed from the repair areas upon completion of repairs and passing of the Post Repair Inspection.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Conform to the latest edition of the following reference standards:
 - .1 ASTM International:
 - .1 ASTM A 53/A 53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A123/A123M, Standard Specification for zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 CSA Group:
 - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA S16, Design of Steel Structures.
 - .3 CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .4 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .5 CSA W59, Welded Steel Construction (Metal Arc Welding).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for sections, pipes, bolts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional Engineer, registered or licensed in the Province of Saskatchewan, Canada for all fabricator-designed assemblies, components and connections.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.
 - .3 Do not proceed with fabrication until Shop Drawings have been reviewed by Engineer.

1.3 QUALITY ASSURANCE

- .1 Test reports: if requested, submit certified test reports showing compliance with specified performance characteristics and physical properties.

- .2 Certifications: if requested, submit product certificates signed by Manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Qualifications of Welders:
 - .1 Welding of load supporting components shall be performed by companies certified by Canadian Welding Bureau in accordance with CSA W47.1.
 - .2 Welders shall be qualified by Canadian Welding Bureau for classification of Work being performed.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Manufacturer's written instructions.
- .2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with Manufacturer's name and address.
- .3 Storage and handling requirements:
 - .1 Store materials off ground, covered and in accordance with Manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections: to CSA G40.20/G40.21, Grade 350W.
- .2 Miscellaneous metal, angles, plates: to CSA G40.20/G40.21, Grade 300W.
- .3 Hollow structural sections: CSA-G40.20/G40.21, 350W Class C.
- .4 Welding materials: to CSA W59.
- .5 Welding electrodes: to CSA W48 Series.
- .6 Bolts: steel to ASTM F3125 Type 1 Grade A325, Galvanized, as shown.
- .7 Anchor bolts: to ASTM A307, galvanized, as indicated in Article 2.2.
- .8 Galvanizing: refer to Section 2.4.1.
- .9 Galvanized primer: zinc rich, ready mix.
- .10 Grout: non-shrink non-metallic, flowable, 24-hour, 15 MPa, pull-out strength 7.9 MPa.
- .11 Shop paint primer: refer to Section 09 91 00 - Painting.
- .12 Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GC-3, for VOC content to be less than 250 g/l.
- .13 Isolation coating: acid and alkali resistant asphaltic paint.
- .14 Grating: Vulcraft Type 30W102, 38x5 GAL, or approved equal.
- .15 Premanufactured roof hatches:

- .1 Bilco Type 50TB or approved equal.
- .2 Size: 760 mm x 915 mm unless otherwise noted on the Drawings.
- .3 Opening extent: 89 degrees.
- .4 Quantity: two.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Exposed welds continuous for length of each joint. File or grind exposed welds smooth and flush.
- .5 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
- .6 Accurately form connections with exposed faces flush:
 - .1 Make mitres and joints tight.
 - .2 Grind or file exposed welds and steel sections smooth.

2.3 SURFACE PREPARATION

- .1 Thoroughly clean and suitably pre-treat steel prior to finishing.
- .2 Remove loose mill scale, rust, oil, grease, dirt and other foreign matter using one or more of the following methods:
 - .1 Solvent cleaning.
 - .2 Wire brushing.
 - .3 Power wire brushing.
 - .4 Sandblasting.
- .3 Grind smooth sharp projections.

2.4 FINISHES

- .1 Galvanized:
 - .1 Hot dip galvanize components to ASTM A123/A123M or CAN/CSA G164.
 - .2 Minimum zinc coating of 600 g/m².
 - .3 Where size permits galvanize components after assembly.
- .2 Zinc rich paint:
 - .1 Clean metal in accordance with surface preparation requirements of the SSPC.
 - .2 Apply one coat of zinc rich paint to all surfaces exposed after assembly to minimum dry film thickness of 60 micrometres. Apply coating immediately after cleaning.

- .3 Isolation Coating:
 - .1 Apply an isolation coating to contact surfaces of following components in contact with cementitious materials and dissimilar metals except stainless steel:
(1) exterior components (2) interior components exposed to high humidity conditions.

Part 3 EMBEDDED METAL ANCHORS

3.1 ANCHOR BOLTS, INSERTS, BOLTS, FASTENERS

- .1 Anchor bolts not supplied by the structural steel fabricator or equipment suppliers to be ASTM A307 sized for full dead and live load.
- .2 Anchor bolts to be mild steel, unless otherwise shown on the drawings, having hexagonal nuts and washers of suitable sizes.
- .3 Concrete anchor bolts to be as indicated on the drawings. Approved Manufacturers are Hilti Canada Ltd., Ramset Fastening Systems, Superior Concrete Accessories, UCAN Fastening Products, and Concrete Chemicals Keystone.
- .4 Bolts, inserts and fasteners permanently embedded in concrete but located outdoors, in wet well floors, walls and ceilings, in chemical handling areas, in equipment rooms subject to drainage, leakage and wash down, and in galleries and trenches to be Galvanized.
- .5 Bolts, inserts and fasteners not permanently embedded in concrete but located indoors where wash down, leakage and drainage are not likely to occur (e.g., in personnel buildings excluding laboratories, on motor floors, in electrical equipment rooms and in control room) may be galvanized steel.

Part 4 Execution

4.1 PERSONNEL

- .1 Workers employed in fabrication of miscellaneous metalwork to be experienced in their respective trades. Welders to possess valid tickets issued by the CWB.
- .2 Workers to be supervised by qualified personnel in conformance with CSA W47.

4.2 FABRICATION

- .1 Dimensions of concrete, vinyl ester or steel framing to be as shown on the drawings and fabrication made to these dimensions.
- .2 Before proceeding with fabrication check site dimensions to ensure proper fit.
- .3 Fabrication of metalwork to be in conformance with good practice of the metal fabrication industry and specified standards. Exposed surfaces to have smooth finishes and sharp, well-defined lines. Edges and corners to be ground smooth. Attachments to be adequate for assembling and securing metalwork in a suitable and substantial manner.

- .4 Use concealed fasteners where practical. Weld connections except where bolting is specified. Metalwork to be drilled and countersunk as required for attachment of hardware or other items.
- .5 Methods of fabrication not specified or shown to be subject to the Engineer's approval prior to use.
- .6 Where possible, work to be fitted and shop assembled, ready for erection.
- .7 For items to be galvanized after fabrication, seal all joints and contact surfaces with continuous welds.

4.3 ERECTION - GENERAL

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Engineer such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CSA S16.
- .7 Deliver items for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up galvanized surfaces with zinc rich primer.

4.4 PRE-MANUFACTURED HATCHES

- .1 Install in accordance with Manufacturer's instructions.
- .2 Submit product design drawings for review and approval to the Engineer before fabrication.
- .3 The installer shall check as-built conditions and verify the Manufacturer's vault access door details for accuracy to fit the application prior to fabrication. The installer shall comply with the vault access door Manufacturer's installation instructions.
- .4 The installer shall furnish mechanical fasteners consistent with the access door Manufacturer's instructions.

4.5 SHOP PAINTING

- .1 Miscellaneous metal to be cleaned, surfaces prepared, and shop prime painted in accordance with CSA S16 with the exception of stainless steel, aluminum, galvanized items and items to be encased in concrete.

4.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Conform to the latest edition of the following reference standards:
 - .1 Canadian Wood Council (CWC):
 - .1 Wood Design Manual.
 - .2 CSA International:
 - .1 CSA B111, Wire Nails, Spikes and Staples.
 - .2 CSA G164, Hot dip Galvanizing of Irregularly Shaped Articles
 - .3 CSA O86, Code for Engineering Design of Wood.
 - .4 CSA O112-M, Standards for Wood Adhesives.
 - .5 CSA O121, Douglas Fir Plywood.
 - .6 CSA O141, Softwood Lumber.
 - .7 CSA O151, Canadian Softwood Plywood.
 - .3 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber.
 - .4 National Research Council Canada (NRC):
 - .1 National Building Code of Canada, 2020 (NBC).
 - .5 All standards are to conform to the latest edition.

1.2 SOURCE QUALITY CONTROL

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, and wood based composite panels in accordance with CSA and ANSI standards.

1.3 DELIVERY/STORAGE

- .1 Protect materials from weather in transit and on-site.
- .2 Store materials on raised supports. Cover materials with tarpaulins or polyethylene sheets to prevent moisture absorption, impairment of structural properties and impairment of aesthetic features.

Part 2 Products

2.1 LUMBER MATERIALS

- .1 Except as indicated or specified otherwise lumber shall be softwood, S4S, moisture content not greater than 19% at time of installation, in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard grading rules for Canadian Lumber, latest edition.

- .3 Plywood underlay, and all other wood material, is to be manufactured without any material that will result in the release of formaldehyde or like gases, detrimental to health.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Glued end jointed (finger-jointed) lumber is not acceptable.
- .4 Studs and joists to be one-piece, full height, and length members.
- .5 Framing and board lumber: to Part 9 of NBC except as indicated otherwise. Wall studs: No. 1/2 SPF.
- .6 Furring, blocking, nailing strips, rough bucks:
 - .1 Use S2S or S4S material.
 - .2 Board sizes: spruce species, NLGA No. 1/2 grade.
- .7 Cants, curbs, nailers for roofing: spruce species, NLGA No. 2 grade.
- .8 Wood furring: spruce species, NLGA No. 1/2 grade.

2.2 PANEL MATERIAL

- .1 Panels to be of type, grade and thickness as specified in accordance with the following standards:
 - .1 Douglas fir plywood: to CSA O121-M, Sheathing grade, except that exposed wood shall be G1S.
- .2 Except as specified otherwise, panels shall be nom. 1200 x 2400 mm size, square edge.
- .3 All plywood to be exterior grade, fabricated using waterproof glue.

2.3 PANEL MATERIALS END USES

- .1 Roof sheathing: Douglas Fir Plywood square edge, thickness as noted.
- .2 Exterior and interior wall sheathing: Douglas Fir Plywood square edges, thickness as noted.
- .3 Pressure treated plywood: as noted on Drawings.

2.4 FASTENINGS & HARDWARE

- .1 In accordance with 2020 National Building Code of Canada (NBCC) as supplemented by following requirements except where specific type is indicated.
- .2 Nails, spikes and staples to 2020 NBCC and CSA B111 except:
 - .1 Use purpose made special coated fastenings for preservative and fire-retardant treated lumber and plywood.

- .3 Bolt, nut, washer, screw and pin type fasteners: with hot-dipped galvanized finish to CSA G164, for exterior work, interior highly humid areas. Use purpose made special coated fastenings, for pressure preservative and fire-retardant treated lumber; elsewhere with primer paint finish where installed on sight-exposed surfaces:
 - .1 Bolts: 19 mm diameter unless indicated otherwise, complete with nuts and washers.
- .4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs.
- .5 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work, interior highly humid areas, pressure-preservative fire-retardant, treated lumber.
- .6 Connectors for wood construction: galvanized steel hangers, purpose made to suit application.
- .7 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy.
- .8 Adhesive: to CAN/CGSB 71.26, cartridge loaded, to equal SS400.
- .9 Clips:
 - .1 Simpson strong tie A23. as indicated on the Contract Drawings.

2.5 WOOD PRESERVATIVE

- .1 Surface and pressure applied wood preservative: conform to CSA 080, latest version.
- .2 Site applied wood preservative: pentachlorophenol base water repellent wood preservative. Minimum two coats.

2.6 ROOF CANTS AND NAILER STRIPS

- .1 Cant strips: wood fibre construction, made from composite 38 mm wood fibre sections sloped to form triangular shape of minimum 89 mm width × 89 mm height.
- .2 Nailer strips: wood nailer strips made from pressure treated lumber of dimension and quantity as indicated on drawings for installation of roof insulation.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for rough carpentry installation in accordance with Manufacturer's written instructions:
 - .1 Visually inspect substrate.
 - .2 Inform Engineer of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 INSTALLATION GENERAL

- .1 Comply with requirements of 2020 NBCC Part 9 supplemented by notes on building and structural drawings and the following paragraphs:
 - .1 Install members true to line, levels and elevations, square and plumb.
 - .2 Construct continuous members from pieces of longest practical length.
 - .3 Install spanning members with “crown-edge” up.
 - .4 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
 - .5 Install sheathing in accordance with requirements of NBCC 2020 or as shown on Contract Drawings.
 - .6 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
 - .7 Countersink bolts where necessary to provide clearance for other work.
 - .8 Use nailing disks for soft sheathing as recommended by sheathing Manufacturer.

3.3 WOOD FRAME CONSTRUCTION

- .1 Comply with requirements of NBCC 2020 Section 9, except where specified otherwise.

3.4 SHEATHING

- .1 Douglas Fir Plywood nailed at 150 o/c on all edges unless noted otherwise.
- .2 Nailing pattern to be included for all edge nailing to blocking.

3.5 MULTI-PLY BUILT UP MEMBERS

- .1 Nails to be spaced a minimum of 200 mm o/c.
- .2 All nails shall penetrate through at least $\frac{3}{4}$ of the thickness of the last individual piece and nails shall be driven alternately from either face of the built-up member along the length.
- .3 Rows of nails perpendicular to length:

Width of Member	Rows of Nails
<114	One
114 to 195	Two
195 to 260	Three
260 to 325	Four

3.6 FURRING AND BLOCKING

- .1 Install furring and blocking as required to space-out and support other work as indicated.
- .2 Install interior strapping to stud walls as detailed.

- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.7 ROUGH BUCKS, NAILERS

- .1 Except where indicated otherwise use material at least 38 mm thick secured with 16 mm bolts located within 300 mm from ends of members and uniformly spaced at 1200 mm between.
- .2 Countersink bolts where necessary to provide clearance for other work.

3.8 ROOF FASCIA, CANTS, NAILERS, CURBS

- .1 Install wood cants, fascia backing, nailers, curbs and other wood supports for roofing and sheet metal work and roof mounted equipment and other items as indicated.
- .2 Secure with galvanized 9 mm bolts where indicated, galvanized nails elsewhere. Locate fastenings within 300 mm from ends and uniformly spaced between. Space bolts at 1200 mm and nails at 600 mm centres except where indicated otherwise.
- .3 Staple and seal vapour retardant sheet strip to underside of nailers before installation. Apply strip continuous with 200 mm overlap at joints, free of wrinkles and tears, with at least 200 mm exposed for overlap on roof deck.
- .4 All fascia, cants, curbs, parapets, etc., above plywood roof deck to be built from pressure treated material, or as indicated on the Drawings.

3.9 APPLIED WOOD PRESERVATIVE

- .1 Use pressure treated plywood and pressure treated dimensional lumber and apply preservative after materials have been cut and fit to size.
- .2 Apply wood preservative to all surfaces of nailers, fascia backing and other materials in direct contact with concrete, masonry, steel deck, roofing or sheet metal exposed to weather with wood preservative before installation. Wherever possible apply preservative after materials have been cut and fit to size.
- .3 Apply preservative to cut surfaces by dipping, or by brush or spray to completely saturate and maintain wet film on surface for minimum 3-minutes soak on lumber and 1-minute soak on plywood.
- .4 Re-treat surfaces exposed by cutting, trimming, or boring with liberal brush application of preservative before installation; minimum two full coats.

3.10 EQUIPMENT BACKBOARD

- .1 Provide backboards for mounting equipment as indicated. Use 19 mm thick DFP/G1S attached to existing masonry brick:
 - .1 Reattach to existing G1S painted wood finish where applicable.

3.11 FRAMING INSPECTION

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Engineer to complete framing inspection.
 - .1 All issues to be rectified and reinspected by the Engineer prior to closing of the ceiling.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Conform to the latest edition of the following reference standards:
 - .1 CSA International:
 - .1 CAN/CSA O80 Series, Wood Preservation.
 - .2 CSA O86 Consolidation, Engineering Design in Wood.
 - .3 CSA O141, Softwood Lumber.
 - .4 CSA S307, Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
 - .5 CSA S347, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
 - .6 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
 - .2 National Lumber Grades Authority (NLGA):
 - .1 Standard Grading Rules for Canadian Lumber 2022.
 - .3 National Research Council Canada (NRC):
 - .1 National Building Code of Canada 2020 (NBC).
 - .4 Truss Plate Institute of Canada (TPIC):
 - .1 TPIC, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for wood trusses and include product characteristics, performance, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Clearly indicate species, sizes and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing and tie-down details, and detailed nailing requirements for ledgers and other connectors. Indicate design load for each member.
 - .2 Submit stress diagram or print out of computer design indicating design load for each truss member, special loads, allowable stress increase and deflection limits. Indicate allowable load and stress increase. Design to be for commercial usage.
 - .3 Prepare engineering design and shop drawings, for each truss type, under the supervision of a Professional Engineer registered to practice in the Province of Saskatchewan for approval. Submit an overall plan, with the individual drawings, to indicate the location of each truss type. The overall plan to also show locations of girder and girder truss points of vertical reactions that require column support.

- .4 Each shop and erection drawing submission shall bear the signature and stamp of a Professional Engineer registered or licensed in province of Saskatchewan.
- .5 Lateral support for the top chord of the trusses will be provided by the specified plywood roof deck. For each type of truss, the truss designer shall indicate the minimum diameter and length of nail and nail spacing/pattern required to laterally support the compression chord members. Nail size and spacing required for diaphragm action and overall building stability is specified by applicable codes or by the Engineer. Unless otherwise specified on the drawings use 65 mm long nails spaced at 150 o/c at edge supports and at 300 o/c at intermediate supports of the plywood decking.
- .6 If the proposed truss design is such that the web members require lateral support between panel points, the design shop drawing shall detail the method of bracing including connections, to the roof diaphragm and/or structural component.
- .7 Provide details for the joist bearing connection and tie-down at each bearing wall.
- .8 Connectors are to be galvanized. Submit data sheets for each type used indicating safe load capacity.
- .9 Provide certification that trusses meet requirements of CSA S347.
- .10 Indicate arrangement of webs or other members to accommodate ducts and other specialties.
- .11 Shop drawings are to show all bracing and blocking members, their locations and their connections in detail for temporary as well as permanent members.
- .12 Show lifting points for storage, handling and erection.
- .13 Show location of lateral bracing for compression members.
- .14 The truss supplier may propose alternate wood trusses to suit the requirement shown on the drawings. The alternate proposal shall be submitted to the Engineer with sufficient details for approval. The Engineer will have the right to modify or reject the alternate proposal.
- .15 The Engineer will review the shop drawings for general conformance to the drawings and specifications. Errors in dimensions, quantity or interference will be noted, if noticed. Responsibility for supplying and finishing the complete work as specified and shown on the drawings shall rest with the Contractor. Commence fabrication only after the Engineer has reviewed the shop drawings.
- .16 Supply to the site with the truss shop drawings, a copy of TPIC brochure "Handling, Erection and Bracing of Wood Trusses".

1.3 INSPECTION AND TESTING

- .1 Materials and workmanship shall be subject to inspection at any time. Provide access to all places where work is being done or material is stockpiled prior to shipment.

1.4 EXAMINATION

- .1 Before commencing erection of the roof trusses, the Contractor is to carefully examine the structure for accuracy and alignment and verify that the work is complete to the point where this installation may properly proceed.
- .2 Notify the Engineer of any discrepancies in writing.

- .3 Commencement of work shall imply acceptance of existing prepared work.

1.5 CERTIFICATES

- .1 Identify lumber by official grade mark containing symbol of grading agency, mill number or name, grade of lumber, species or species groupings or combination designation, rules under which graded and condition of seasoning at time of manufacture.

1.6 QUALIFICATIONS OF MANUFACTURERS

- .1 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.
- .2 Fabricator of trusses to be a member of the Western Wood Truss Association of Saskatchewan and Manitoba.

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Fabricator to have minimum of 5-years experience in design and manufacturing comparable wood trusses. Minimum of 3-years experience in the erection of comparable wood trusses.
 - .2 Fabricator of trusses to be a member of the Western Wood Truss Association of Saskatchewan and Manitoba.
 - .3 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Store trusses at site on skids raised off the ground and in accordance with Manufacturer's instructions. Provide bearing supports and bracing to prevent bending or overturning of trusses during transit and storage.
- .2 Replace defective or damaged materials with new.
- .3 Cover the entire pile with tarpaulins or polyethylene to provide protection from the elements.
- .4 In unloading and erection, use pads or blocking between slings and truss members.
- .5 Protect trusses from construction operations.

1.9 DESIGN REQUIREMENTS

- .1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA O86.
- .2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.
- .3 Design trusses, bridging, bracing and all secondary framing not otherwise sized or specified in accordance with CSA-086 and TPIC Truss Design Procedures, for loads indicated and minimum concentrated loadings stipulated in NBCC 2020 commentary.

- .4 Coordinate the truss layout with Contract Drawings. Trusses to be 2 or 3-ply where required to satisfy bearing capacity.
- .5 Limit live load deflection to $\frac{1}{360}$ th of span.
- .6 Provide camber for trusses as required.
- .7 Truss design to accommodate diaphragm action on chords to distribute wind loads.

Part 2 Products

2.1 MATERIALS

- .1 Lumber: Douglas Fir or SPF Species to CSA O141 and NLGA Standard Grading Rules, S4S, with maximum moisture content of 19% at time of fabrication. Lumber to be of grade capable of carrying the design loads within allowable stresses permitted by CSA 086.
- .2 Connector plates: galvanized sheet steel to ASTM, 1446, grade A, with G90 coating designation and with holes, plugs, teeth or prongs uniformly spaced and formed.
- .3 Nails: zinc coated steel to CSA B111, sized as required.
- .4 Screws: cadmium plated steel, purpose made to CSA B35.4.
- .5 Lag screws: to CSA B34.
- .6 Metal gussets: carbon steel plate to CSA G40.21, type 38W.
- .7 Plywood gussets: plywood to CSA O151 or CSA O121.
- .8 Truss anchors: galvanized metal anchors with minimum uplift resistance of 1.5 kN or as required by loads presented.
- .9 Fastenings: to CSA-O86.

2.2 FABRICATION

- .1 Fabricate wood trusses in accordance with reviewed Shop Drawings.
- .2 Fabricate wood trusses in a properly equipped shop by skilled workmen under strict rules of inspection and quality control as required by related codes and standards.
- .3 Cut truss members to accurate length, angle and size to assure tight joints for finished trusses.
- .4 Assemble truss members to design configuration by securing tightly in jigs or with clamps.
- .5 Provide for design camber and roof slopes when positioning truss members.
- .6 Connect members using metal connector plates and girder trusses using bolts, nuts and washers.
- .7 Inspection of trusses during fabrication shall be carried out by the Engineer responsible for the design or by a mutually agreed upon impartial technical inspection agency. Cost of inspections to be borne by the Fabricator.

2.3 SOURCE QUALITY CONTROL

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

Part 3 Execution

3.1 EXAMINATION

- .1 Before commencing erection of the roof trusses, the Contractor to carefully examine the structure for accuracy and alignment and verify that the work is complete to the point where this installation may properly proceed.
- .2 Notify the Engineer of any discrepancies in writing.
- .3 Commencement of work shall imply acceptance of existing prepared work.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with Manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.3 ERECTION

- .1 Refer to TPIC Brochure "Handling, Erection and Bracing of Wood Trusses". Erect trusses in accordance with the reviewed Shop Drawing.
- .2 Hoist trusses into position with cables, spreader bars, strongbacks, as required, secured at designated lift points in accordance with Manufacturer's instructions.
- .3 Make adequate provisions for possible erection stresses.
- .4 Exercise care to keep out-of-plane bending of trusses to minimum. Install temporary horizontal and cross bracing to hold trusses plumb and true and in safe condition until permanent bracing and decking are installed. For bottom chord bearing joists provide diagonal bridging or suitable method of lateral stabilization adjacent to the bearing line.
- .5 Nail plywood deck to trusses with nails at the minimum spacing indicated previously in this section or with nails at spacings specified on the Drawings.
- .6 Install permanent bracing (in accordance with the reviewed shop drawings and the project drawings) and related components prior to application of loads to trusses.
- .7 Restrict construction loads to prevent overstressing of truss members. Do not drill holes in truss members nor use lag screws or bolts in or through members.
- .8 Do not cut or remove any truss members.
- .9 Fasten 19 × 89 and/or 38 × 89 bridging and bracing members to trusses members with two 90 mm long nails at each truss member unless specified otherwise in the Drawings.
- .10 Roof trusses to be centered above wood studs below. Add additional wall studs, if required, to suite truss spacing.
- .11 Replace trusses that are damaged. Do not repress truss plates that show signs of withdrawal.

- .12 Trusses are to be secured to their supports by galvanized framing anchors. Toe-nailing will not be allowed.
- .13 Partial site assembly - if it is intended to partially assemble trusses with other components at site adjacent to the building submit shop drawings detailing all temporary and permanent components, lifting beams and pick up points. Shop drawings to be stamped by a Registered Professional Engineer registered to provide consulting services in Saskatchewan.

3.4 FIELD QUALITY CONTROL

- .1 The Engineer will inspect the wood stud bearing wall system and the wood truss roof system. The Contractor to advise when construction of the two systems is complete. Inspections will be carried out before roofing, insulation, ceilings and interior wall finishes are installed. Prior to this site inspection, the Engineer responsible for the design of the trusses shall inspect during construction and at completion of erection, shall provide certification that trusses have been fabricated and erected in accordance with the design.

3.5 CLEANING

- .1 Progress cleaning: clean in accordance with Division 01.
- .2 Final cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01.

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

- .1 The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of fibre reinforced plastic (FRP) systems.
- .2 Substitution of any component or modification of system shall be made only when approved by the Engineer.
- .3 Fabricator qualifications: firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capability to produce required units without causing delay in the work.
- .4 In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.2 SUBMITTALS

- .1 Shop drawings of all FRP structural members, plates and appurtenances shall be submitted to the Engineer for review in accordance with the requirements of Division 01.
- .2 Ladder design to be sealed and signed by a Professional Engineer registered to practice in the Province of Saskatchewan.

Part 2 Products

2.1 MATERIALS

- .1 Materials used in the manufacturing of the FRP products shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.
- .2 All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.
- .3 All FRP products shall be manufactured using a pultruded process utilizing either an isophthalic polyester or vinyl ester resin with flame retardant and ultraviolet (UV) inhibitor additives. A synthetic surface veil shall be the outermost layer covering the exterior surface.
- .4 After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.
- .5 FRP products exposed to weather shall contain an ultraviolet inhibitor and shall additionally receive 1 mil thick UV coating to shield from ultra-violet light if specified or requested.

- .6 All exposed surfaces shall be smooth and true to form.
- .7 The FRP shapes and resins shall be approved by NSF or other recognized North American regulatory agencies for use in food grade/potable water applications.

2.2 FABRICATION

- .1 All FRP components shall be fabricated to the sizes shown on the reviewed Shop Drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 All FRP fabrications shall be installed as shown on the reviewed Shop Drawings.
- .2 Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- .3 Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
- .4 All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.
- .5 Install items specified as indicated and in accordance with Manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 STANDARDS

- .1 ASTM International:
 - .1 ASTM C553-13, Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 ASTM C665-12, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - .3 ASTM C1320-10, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 CSA Group:
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .3 Underwriters Laboratories of Canada (ULC).
- .4 CAN/ULC-S702-2012, Standard for Mineral Fibre Insulation for Buildings.

1.2 QUALITY ASSURANCE

- .1 All insulation work described in this Section shall be executed by experienced personnel under the direction of a skilled foreman who shall be on site at all times during the Work.
- .2 Report to Engineer, in writing, any conditions or defects encountered on the site during construction upon which the work of this Section depends and which may adversely affect its performance.
- .3 Rejected work shall be made good to the Engineer's approval, at the Contractor's expense.
- .4 Materials and methods of application specified herein must be strictly adhered to. Where a situation occurs, that conformance is in question, notify Engineer immediately for further instructions.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for blanket insulation and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Submit product certificates signed by Manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

- .4 Test reports:
 - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.4 COORDINATION

- .1 Coordinate work of this Section where it meets similar work to ensure a continuous unbroken air and vapour barrier, and insulation blanket to give complete protection from cold penetration.

1.5 DELIVERY/STORAGE

- .1 Deliver insulation materials in original unopened packages or wrappings with manufacturer's markings clearly visible. Store materials on raised platforms in weatherproof shelters. Protect from damage and disfiguration.

1.6 INSPECTION

- .1 Inspection of the vapour barrier installation will be carried out by the Engineer.
- .2 Do not proceed with installation of ceiling covering until vapour barrier installation is completed to the requirements of these specifications.

Part 2 Products

2.1 INSULATION

- .1 Thermal batt insulation: mineral fibrous glass friction fit unfaced type to CSA A101, to RSI or thickness as shown.

2.2 ANCHORS AND FASTENERS

- .1 Staples: galvanized wire, 12 mm minimum leg.

2.3 VAPOUR BARRIER AND ADHESIVES

- .1 Vapour barrier: clear polyethylene film to CAN-CGSB 51.34, 0.152 mm thickness. Tape for sealing as recommended by manufacturer, or acoustical sealant for lap joints.
- .2 Vapour barrier edge stripping - butyl: Maraflex type 1M-0.76 mm thick, of widths to suit application.
- .3 Vapour barrier extension: 2.5 mm composite sheet, conforming to CGSB 37-GP-56M. Bakelite Blueskin or approved equal.
- .4 Acoustical sealant: to CGSB-19-GP-21, Allied Chemical AC-40.

Part 3 Execution

3.1 GENERAL

- .1 Install insulation after building substrata materials are dry.
- .2 Install insulation to maintain continuity of thermal barrier protection to building elements and spaces.
- .3 Fit insulation tight to ducts and protrusions.
- .4 Install materials in accordance with Manufacturer's instructions.

3.2 BATT INSULATION AND VAPOUR BARRIER APPLICATION

- .1 Install batt insulation between all framing components as indicated.
- .2 Apply polyethylene vapour barrier to inside of insulation, lap joints one frame member space and seal by tape. Staple vapour barrier securely in place or seal at lap joints with acoustical sealant securely sandwiched between frame members and plywood. Seal vapour barrier at wall/roof locations. Ensure vapour barrier is sealed at all edges, cuts and openings. Coordinate roof/wall construction to maintain continuity at vapour barrier.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Seal perimeter of sheet vapour barrier as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.
 - .3 Install staples through lapped sheets at sealant bead into wood substrate.
 - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .5 Seal lap joints of sheet vapour barrier as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
 - .4 Install staples through lapped sheets at sealant bead into wood substrate.
 - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .6 Inspect sheets for continuity. Repair punctures and tears with sealing tape before work is concealed.
- .7 Ensure all wall and ceiling spaces exposed to outside air are insulated.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Conform to the latest edition of the following reference standards:
 - .1 ASTM International:
 - .1 ASTM C208, Standard Specification for Cellulosic Fiber Insulating Board.
 - .2 ASTM C591, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - .3 ASTM C612, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
 - .4 ASTM C1126, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - .5 ASTM C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - .6 ASTM E96/E96M, Standard Test Methods for Water Vapour Transmission of Materials.
 - .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 71-GP-24M-AMEND-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
 - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (SDS).
 - .4 Underwriters Laboratories of Canada (ULC):
 - .1 CAN/ULC-S702-2012, Standard for Mineral Fibre Insulation for Buildings.
 - .2 CAN/ULC-S704-11, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for board insulation and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Submit product certificates signed by Manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Test reports:
 - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.

- .5 Manufacturer's instructions:
 - .1 Submit Manufacturer's installation instructions.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Division 01 and with Manufacturer's written instructions.
- .2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with Manufacturer's name and address.
- .3 Storage and handling requirements:
 - .1 Store materials in dry location off ground and in accordance with Manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 INSULATION

- .1 Extruded polystyrene (XPS): to CAN/ULC-S701:
 - .1 Type: 4.
 - .2 Thickness: as indicated.
 - .3 Edges: ship lapped.

2.2 ADHESIVE

- .1 Adhesive (for polystyrene): low VOC, as recommended by insulation board Manufacturer.

2.3 ACCESSORIES

- .1 Insulation clips: Hilti IDP Insulation anchors installed @ 1200 o/c or minimum four per section of insulation:
 - .1 For installation on exterior face of wet well walls.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine substrates and immediately inform Engineer in writing of defects.
- .2 Prior to commencement of work, ensure: Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.2 INSTALLATION

- .1 Install insulation after building substrate materials are dry.

- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .5 Offset both vertical and horizontal joints in multiple layer applications.
- .6 Do not enclose insulation until it has been inspected and approved by Engineer.

3.3 RIGID INSULATION INSTALLATION

- .1 Apply adhesive to insulation board in accordance with Manufacturer's recommendations.
- .2 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.
- .3 In addition to adhesive, install mineral fibre insulation boards with insulation clips as required, to ensure insulation remains in place on wall, fit boards tight, cut off fastener spindle 3 mm beyond disk.
- .4 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm polyethylene strip over expansion and control joints using compatible adhesive before application of insulation.

3.4 PERIMETER FOUNDATION INSULATION

- .1 Exterior application: install perimeter foundation insulation where shown on the Drawings.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.
 - .2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for vapour retarders and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates:
 - .1 Submit product certificates signed by Manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with Manufacturer's written instructions.
- .2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with Manufacturer's name and address.
- .3 Storage and handling requirements:
 - .1 Store materials off ground and in accordance with Manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SHEET VAPOUR BARRIER

- .1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.
- .2 Wall vapour retarder (self-adhesive): SBS modified bitumen membrane over cross-laminated polyethylene grid, self-adhering, self-sealing, 1.0 mm thickness. Designed to act as an impermeable Air/Vapour retardant sheet membrane to CGSB 37-GP-56M and ASTM E96. Water Vapour Permeance of <0.03, Air Permeability of <0.0005 @ 75 Pa.

- .1 Acceptable Products:
 - .1 Bakor: Blueskin SA LA applied over Blueskin primer.
 - .2 Iko Aquabarrier AVB applied over Aquabarrier primer.
 - .3 Soprema: Sopraseal Stick 1100T applied with Elastocol 700 primer.
- .3 Vapour retarder extension: SBS modified bitumen membrane over cross-laminated polyethylene grid, self-adhering, self-sealing, designed to act as a transition sheet membrane to CGSB 37-GP-56M and ASTM E96.
 - .1 Acceptable Products:
 - .1 Bakor: Blueskin SA LA applied over Blueskin primer.
 - .2 Iko Aquabarrier AVB applied over Aquabarrier primer.
 - .3 Soprema: Sopraseal Stick 1100T applied with Elastocol 700 primer.

2.2 ACCESSORIES

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier Manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.
- .2 Sealant: compatible with vapour retarder materials, recommended by vapour retarder Manufacturer.
- .3 Staples: minimum 6 mm leg.
- .4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for vapour retarder installation in accordance with Manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Engineer of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Engineer.

3.2 INSTALLATION

- .1 Ensure services are installed and inspected prior to installation of retarder.
- .2 Use sheets of largest practical size to minimize joints.
- .3 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.3 EXTERIOR SURFACE OPENINGS

- .1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.4 PERIMETER SEALS

- .1 Seal perimeter of sheet vapour barrier as follows:
 - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
 - .2 Lap sheet over sealant and press into sealant bead.
 - .3 Install staples through lapped sheets at sealant bead into wood substrate.
 - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 LAP JOINT SEALS

- .1 Seal lap joints of sheet vapour barrier as follows:
 - .1 Attach first sheet to substrate.
 - .2 Apply continuous bead of sealant over solid backing at joint.
 - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
 - .4 Install staples through lapped sheets at sealant bead into wood substrate.
 - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 ELECTRICAL BOXES

- .1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
 - .1 Wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.
 - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.7 CLEANING

- .1 Progress cleaning: clean in accordance with Division 01.
 - .1 Leave Work area clean at end of each day.
- .2 Final cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01.
 - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 All standards are to be to the latest edition.
- .2 American Society of Mechanical Engineers (ASME):
 - .1 ASME B18.6.3, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).
- .3 ASTM International (ASTM):
 - .1 ASTM D2369-10(2015)e1, Test Method for Volatile Content of Coatings.
 - .2 ASTM D2832-92(2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - .3 ASTM D3679-13, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding.
 - .4 ASTM D4756-15, Standard Practice for Installation of Rigid Poly (Vinyl Chloride) (PVC) Siding and Soffit.
 - .5 ASTM D7445-09, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding with Foam Plastic Backing (Backed Vinyl Siding).
- .4 CSA Group:
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .6 Vinyl Siding Institute (VSI):
 - .1 Vinyl Siding Installation Manual.

1.2 ADMINISTRATIVE REQUIREMENTS

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for plastic siding and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Indicate dimensions, siding and soffit profiles, attachment methods, schedule of wall elevations, and related work.
- .4 Samples:
 - .1 Submit sample of siding and colour.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Operation and maintenance data: submit operation and maintenance data for installed products for incorporation into manual.
- .3 Warranty documentation: submit warranty documents specified.

1.5 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by Manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Manufacturer qualifications: completed VSI Vinyl Siding Certification Programs.
- .4 Installer qualifications: minimum 3-years documented experience with products specified or who has passed Vinyl Siding Institute's (VSI) Certified Installer Program.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with Manufacturer's written instructions.
- .2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with Manufacturer's name and address.
- .3 Storage and handling requirements:
 - .1 Store materials in dry location off ground and in accordance with Manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect plastic siding from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

- .1 Execute work of this Section within environmental conditions (temperature, humidity, and ventilation) within limits recommended by Manufacturer.

1.8 WARRANTY

- .1 Manufacturer's warranty: submit, for Engineer acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty in addition to and not limit other rights Owner may have under Contract Documents.

Part 2 Products

2.1 MATERIALS

- .1 Vinyl siding:
 - .1 In accordance with ASTM D3679.
 - .2 Finish: to match existing finish.

- .3 Bevel profile: horizontal.
- .4 Panel width: to match existing x maximum permissible length.
- .5 Colour: as selected by the Engineer to match the existing finish from manufacturers standard.
- .2 Accessories: internal corners, external corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of extruded plastic, same material and colour as siding, with nailing strip pre-punched.
- .3 Exterior wall sheathing paper: to CAN/ULC-S741, single ply type as indicated:
 - .1 Adhesives and sealants: in accordance with Division 07.
 - .2 Test for acceptable VOC emissions in accordance with ASTM D2369 and ASTM D2832.
 - .3 Adhesives and sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .4 Fasteners: nails to CSA B111, screws to ASME B18.6.3 galvanized steel, purpose made.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts acceptable in accordance with Manufacturer's written instructions.
 - .1 Inform Engineer of unacceptable conditions immediately upon discovery.
 - .2 Proceed with installation only after unacceptable conditions remedied and after receipt of written approval to proceed from Engineer.

3.2 PREPARATION

- .1 Clean surfaces thoroughly prior to installation.
- .2 Repair substrate flaws or defects before applying siding or soffits.
- .3 Fur surfaces to even plane and free from obstructions.
- .4 Prepare surfaces using methods recommended by Manufacturer for achieving best result for substrate under project conditions.

3.3 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with Manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions and data sheets.

3.4 INSTALLATION

- .1 Install in accordance with ASTM D4756 and VIS Vinyl Siding Installation Manual.
- .2 Install one layer sheathing paper horizontally by stapling lapping edges 75 mm.
- .3 Opening flashings, starter strips, inside corners, edgings, drip and cap.
- .4 Install siding sequentially from starter strip up, in accordance with Manufacturer/Fabricator's written instructions.

- .5 Install exterior corners, fillers and closure strips with carefully formed and profiled work.
- .6 Maintain joints in exterior panels, true to line, tight fitting, hairline joints.
- .7 Seal junctions with dissimilar materials with sealant. Do work in accordance with Division 01.
- .8 Attach components in manner not restricting thermal movement. Conceal fasteners where possible.

3.5 CLEANING

- .1 Progress cleaning: clean in accordance with Division 01.
 - .1 Leave Work area clean at end of each day.
- .2 Final cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 01.

3.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 MATERIAL HANDLING

- .1 Store and handle materials to prevent damage to formed shapes and deterioration due to corrosive matter.

1.2 SUBMITTALS

- .1 Submit 50 x 50 mm samples of each type of sheet metal materials, colour and finish in accordance with Division 01.

Part 2 Products

2.1 SHEET METAL FLASHINGS AND FASTENING

- .1 Galvanized steel: 0.56 mm core thickness, sheet formed from zinc coated steel 381 g/m² galvanized ASTM A525.
- .2 Nails, screws, bolts, nuts, galvanized steel for galvanized steel flashings; 1.06 mm thick washers with rubber backing.
- .3 Bituminous paint: to CGSB 1-GP-108, Type II.
- .4 Prefinished metal flashings: 0.46 mm thick prefinished steel.
- .5 Locking strip: 0.46 mm thick steel, prefinished.

2.2 SHEET METAL FLASHING FABRICATION

- .1 Fabricate metal flashings and other sheet metal work to standards of CRCA "FL" series specifications and as detailed.
- .2 Form pieces in 3 m maximum lengths. Allow for expansion at joints.
- .3 Form pieces true and square, sized accurately, and free from distortion.
- .4 Where structural members, including equipment supports pass through roof membrane, include pitch pocket filling for watertight collars and caps where shown (minimum 100 mm flanges). Coordinate details with installation of membrane roofing.
- .5 Drip leg of flashings: minimum of 62 mm.
- .6 All joints are to be watertight either by caulking or by soldering.
- .7 All fasteners to be non-corrosive materials.

2.3 DOWNSPOUTS AND GUTTERS

- .1 All eavestroughs to be continuous 100 mm colour to match soffits. All downspouts to be 100 mm HSS steel epoxy coated colour to match fascia.

Part 3 Execution

3.1 INSTALLATION

- .1 Counterflash membrane flashings at intersections of roof with vertical surfaces and curves.
- .2 Lap flashings forming tight fit over lock seam. Use exposed fastenings only where approved by the Engineer.
- .3 Install flexible flashings where shown on drawings. Lap joints and seal with recommended adhesive to form continuous flashing. Adhere flashing to back up with recommended adhesive. Seal top edge to back up.
- .4 Provide and install all sealant necessary to seal between work of this Section and dissimilar materials. Conform to all requirements of Division 07.

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

- .1 The Contractor shall read and be governed by the General Conditions, General Instructions, Instructions to Bidders, Addenda, Form of Bid and Agreement of the complete Specifications for this project.
- .2 The complete work under this Section shall be governed by the dictates of good practice in all details of materials and methods even if not minutely specified. The work shall be properly coordinated with the requirements of other units of work specified in other sections.

1.2 REFERENCE STANDARDS

- .1 Aluminum Association (AA):
 - .1 DAF-45-R03, Designation System for Aluminum Finishes - 9th Edition.
 - .2 ASM-35-October 2000, Specifications for Aluminum Sheet Metal Work in Building Construction, Section 5.
- .2 ASTM International:
 - .1 ASTM A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A792/A792M-10, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
 - .3 ASTM B32-08, Standard Specification for Solder Metal.
 - .4 ASTM B370-11, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .5 ASTM D523-89(2008), Standard Test Method for Specular Gloss.
 - .6 ASTM D822-01(R2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian General Standards Board (CGSB):
 - .1 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
 - .2 CAN/CGSB-37.29-M89, Rubber-Asphalt Sealing Compound.
 - .3 CAN/CGSB-51.32- M77, Sheathing, Membrane, Breather Type.
 - .4 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .4 CSA Group (CSA):
 - .1 CSA A123.3-05(2010), Asphalt Saturated Organic Roofing Felt.
- .5 Department of Justice Canada (Jus):
 - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (SDS).

- .7 National Building Code of Canada 2020 (NBC):
 - .1 CCMC- Registry of Product Evaluations.
- .8 Transport Canada (TC).
- .9 Transportation of Dangerous Goods Act (TDGA), 1992.

1.3 QUALIFICATION OF APPLICATOR

- .1 The work of this section shall be carried out by experienced and competent subcontractors. Subcontractors for this work must be authorized by the Manufacturer.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Proof of Manufacturer's CCMC listing and listing number.
- .3 Shop Drawings:
 - .1 Submit Drawings stamped and signed by professional engineer registered or licensed in the province of Saskatchewan, Canada.
 - .2 Submit Shop Drawings as described elsewhere.
 - .3 Indicate arrangement of roof sheets including joints, types, and location of supports, fasteners, any special shapes, and roof penetration details.
- .4 Samples:
 - .1 Submit 300 x 300 mm samples of each sheet metal material.

1.5 DESIGN CRITERIA

- .1 Design roof panel system to allow for thermal movement of components caused by ambient temperature range of 80°C without causing buckling, failure to joint seals, undue stress on fasteners or other detrimental effects.

1.6 WARRANTY

- .1 Contractor hereby warrants that the sheet metal roofing system will remain leak proof for 2-years. The warranty shall commence on the date of issuance of Final Certificate of Completion.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with Manufacturer's written instructions.
- .2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with Manufacturer's name and address.

- .3 Storage and handling requirements:
 - .1 Store materials in accordance with Manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.8 PROTECTION

- .1 Protect prefinished steel during fabrication, transportation, site storage, and erection in accordance with CSSBI Standards.

Part 2 Products

2.1 MATERIALS

- .1 Sheet metal roofing: aluminum-zinc alloy coated steel sheet to ASTM A792M, grade 27, coating designation AZ150, minimum 0.61 mm (24 ga) base metal thickness:
 - .1 Profile: Viewest Tradition 100.
 - .2 Colour: as selected by the Engineer to match existing roof finish from Manufacturer's standards.
- .2 Roof panel support system: concealed fastener, purpose-made thermally responsive clip system, designed to accommodate panel depth and allow full thermal expansion and contraction of roof sheet. Provide clips with minimum Z275 zinc coating.
- .3 Underlayment: rubberized asphalt membrane with high density polyethylene top sheet, minimum thickness 1 mm (40 mils), Ice and Water Shield as manufactured by Grace.
- .4 Vents and flashings: material, thickness, coating and finish to match roof sheet.
- .5 Closures: as recommended by roofing system Manufacturer.
- .6 Sealants: as recommended by roofing system Manufacturer.
- .7 Fasteners: galvanized steel, sized by the roofing system Manufacturer to meet load requirements and to maintain a watertight installation. Heads of fasteners in areas exposed to view shall have matching colour to panel material being fastened.

2.2 FABRICATION

- .1 Fabrication roofing system components to comply with dimensions, profiles, thicknesses, and details as shown on the design Drawings and specified herein, factory-ready for field installation.
- .2 Form individual pieces in maximum practicable lengths. Make allowances for expansion at joints.
- .3 Hem exposed edges on underside 12 mm, miter and seal.

- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance and performance.
- .5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

Part 3 Execution

3.1 INSTALLATION

- .1 Use concealed fastenings except where approved by Engineer before installation.
- .2 Provide underlayment under sheet metal roofing installed in accordance with manufacturer's printed instructions. Lap joints 150 mm.
- .3 Install sheet metal roof panels using concealed clips anchored to wood blocking.
- .4 Secure clips with minimum two fasteners each.
- .5 Align transverse seams in adjacent panels.
- .6 Flash roof penetrations with material matching roof panels and make watertight.
- .7 Form seams in direction of water flow and make watertight.

3.2 STANDING SEAM ROOFING

- .1 Install exterior prefinished roof panels on panel support clips, using Manufacturer's proper construction procedure.
- .2 Provide notched and formed closures, sealed against weather penetration, at changes in pitch and at ridges.

3.3 FLASHING INSTALLATION

- .1 Use concealed fasteners except where approved by Engineer before installation. Exposed fasteners to be same colour as roofing and flashing sheet.
- .2 Lock end joints and caulk to provide weathertight seal.

3.4 TOUCH UP AND CLEANING

- .1 Touch up minor paint abrasions with touch up paint.
- .2 Clean roof by dry-wiping.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Conform to the latest edition of the following reference standards:
 - .1 ASTM International:
 - .1 ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications.
 - .2 Canadian General Standards Board (CGSB):
 - .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
 - .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .5 CAN/CGSB-19.18, Sealing Compound, One Component, Silicone base, Solvent Curing.
 - .6 CAN/CGSB-19.24, Multi-component, Chemical Curing Sealing Compound.
 - .3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards:
 - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 01.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Manufacturer's product to describe:
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.3 DELIVERY, STORAGE AND HANDLING

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

- .2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with Manufacturer's name and address.
- .3 Storage and handling requirements:
 - .1 Store materials indoors and in accordance with Manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect joint sealants from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.4 QUALITY ASSURANCE

- .1 Employ qualified competent tradesmen, fully experienced in this type of work, and furnish evidence of qualifications, if requested by Engineer.
- .2 Prior to commencing work, review all requirements and conditions with the sealant Manufacturer's representative in order to ensure correct methods in preparation and application of materials.

1.5 SITE CONDITIONS

- .1 Ambient conditions:
 - .1 Proceed with installation of joint sealants only when:
 - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant Manufacturer.
 - .2 Joint substrates are dry.
 - .3 Conform to Manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-width conditions:
 - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant Manufacturer for applications indicated.
- .3 Joint-substrate conditions:
 - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 EXISTING CONDITIONS

- .1 Examine substrate materials, joint voids, and note temperature/humidity conditions.
- .2 Commencement of work implies acceptance of site conditions.

1.7 GUARANTEE

- .1 Provide written guarantee, signed and issued in name of the Owner, stating that work in this section is guaranteed against leaks, cracking, crumbling, running, melting, hardening, sagging, bleeding, shrinking, loss of adhesion, or staining adjacent surfaces for a period of 3-years from Date of Substantial Performance, and that any defective sealant work will be repaired and damaged surfaces repaired, at no cost to the Owner.

Part 2 Products

2.1 SEALANT MATERIALS

- .1 Sealants and caulking compounds must:
 - .1 Meet or exceed all applicable governmental and industrial safety and performance standards; and
 - .2 Be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the Fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .2 Sealant and caulking compounds must not be formulated or manufactured with aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulphate.
- .3 Sealant and caulking compounds must not contain a total of volatile organic compounds (VOCs) in excess of 5% by weight as calculated from records of the amounts of constituents used to make the product.
- .4 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.
- .5 The manufacturing process must adhere to Lifecycle Assessment Standards as per ISO 14040/14041 LCA Standards and CSA Z760-94 LCA Standards.
- .6 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Type S-1: acrylic latex one part:
 - .1 To CAN/CGSB-19.17.
 - .2 Acceptable materials:
 - .1 Latacalk, Chemtron.
 - .2 Sonolac, BASF Sonneborn.
 - .3 Tremflex 834, Tremco.
- .2 Type S-3: silicone sealant; general construction and air-seal sealant:
 - .1 To CAN/CGSB-19.13 and ASTM C920: type S; grade NS; class 25; use NT, M, G, A, O.
- .3 Type S-5: acoustical sealant; interior, non-hardening:
 - .1 To CAN/CGSB-19.21.
 - .2 Acceptable materials:
 - .1 Acoustical Sealant, Tremco; or.
 - .2 Metaseal, Chemtron.

- .4 Type S-6: multi-component polyurethane sealant; chemical curing, exterior wall sealant:
 - .1 To CAN/CGSB-19.24 and ASTM C920: type M; grade NS; class 50; use T, NT, M, A, O.
 - .2 Acceptable materials:
 - .1 Dymeric, Tremco;
 - .2 Sikaflex 2c NS, Sika; or
 - .3 Sonolastic NP 2, BASF Sonneborn.
- .5 Type S-7: one-component polyurethane sealant; non-sag, for general constructions:
 - .1 To CAN/CGSB-19.13 and ASTM C920: type S; grade NS; class 25; use NT, M, A, O.
 - .2 Acceptable materials:
 - .1 Dymonic or Dymonic FC, Tremco Inc.;
 - .2 Multiflex, Chemtron;
 - .3 Sonolastic NP 1, BASF Sonneborn; or
 - .4 Sikaflex 1a, Sika.
- .6 Type S-8: horizontal joint sealant; two-component, self-levelling:
 - .1 To CAN/CGSB-19.24 and ASTM C920: type M; grade P; class 25; use T, M, O.
 - .2 Acceptable materials:
 - .1 Sikaflex 2c SL, Sika;
 - .2 Sonolastic SL 2, BASF Sonneborn; or
 - .3 THC-901, Tremco Inc.
- .7 Type S-9: one-part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to ASTM C920, type S, grade P, class 50, use T, M, A, O and CAN/CGSB 19.13, MC-1-25-B-N:
 - .1 Acceptable materials:
 - .1 Sonolastic SL 1, BASF Sonneborn; or
 - .2 Vulkem 45 SSL, Tremco Inc.
- .8 Type S-10: control joint sealant: Two-component, urethane, self-levelling, load bearing saw cut or preformed control joints, light gray colour:
 - .1 By request of the Owner, acceptable materials are:
 - .1 Euclid, Euco QWIKjoint UVR; or
 - .2 Substitutions will be considered for this material upon approval of the Engineer.
- .9 Type S-11: one-component polyurethane sealant; medium-modulus, low-VOC, UV stable:
 - .1 To CAN/CGSB-19.13 and ASTM C920: type S; grade NS; class 50; use NT, T, M, A, O, I.
 - .2 Acceptable materials:
 - .1 Dymonic 100, Tremco Inc.; or

- .2 Substitutions will be considered for this material upon approval of the Engineer.

2.3 SEALANT SELECTION

- .1 Where no specified type of sealant is shown or specified, choose one of the sealants specified in this Section appropriate for its location.
- .2 Make sealant selections consistent with Manufacturer's recommendations.
- .3 Use acrylic sealant Type S-1 only on the interior and only in situations where little or no movement can occur.
- .4 Use silicone general construction sealant Type S-3 or Type S-6 for all joints, interior and exterior, where no other specific sealant type specified.
- .5 Use acoustical sealant Type S-5 and air seal sealant Type S-3 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.
- .6 Use multi-component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.
- .7 Use multi-component sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.
- .8 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.
- .9 Use sealant S-11 for sealing exterior holes and penetrations around pipes and other services passing through concrete foundations.

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant Manufacturer's written recommendations.
- .2 Primer: in accordance with sealant Manufacturer's written recommendations.

Part 3 Execution

3.1 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with Manufacturer's directions.

3.2 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant Manufacturer's instructions immediately prior to caulking.

3.3 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to Manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.4 MIXING

- .1 Mix materials in strict accordance with sealant Manufacturer's instructions.

3.5 APPLICATION

- .1 Sealant:
 - .1 All joints and gaps are to be sealed with the correct sealant material to leave a smooth finished surface.
 - .2 Apply sealant in accordance with Manufacturer's written instructions.
 - .3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .4 Apply sealant in continuous beads.
 - .5 Apply sealant using gun with proper size nozzle.
 - .6 Use sufficient pressure to fill voids and joints solid.
 - .7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .8 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .9 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing:
 - .1 Cure sealants in accordance with sealant Manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.

3.6 PROTECTION

- .1 Protect installed work of other trades from staining or contamination.

END OF SECTION

Part 1 General

1.1 QUALITY ASSURANCE

- .1 Contractor shall have a minimum of 5-years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest Master Painters Institute (MPI) requirements for painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification.
- .6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by the Engineer.
- .7 Standard of acceptance:
 - .1 Walls: no defects visible from a distance of 1000 mm at 900 to surface.
 - .2 Ceilings: no defects visible from floor at 450 mm to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
 - .4 Piping and mechanical components: defects visible from a distance up to 1500 mm.

1.2 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

- .1 Provide paint products meeting MPI "Environmentally Friendly" ratings based on VOC (EPA Method 24) content levels.
- .2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 rating.

1.3 SCHEDULING OF WORK

- .1 Notify Engineer 24-hours in advance of prime coat applications to all surfaces including piping, equipment, walls and floors.
- .2 Do not proceed with finish coats until Engineer's approval has been received for prime coats.

- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.4 SUBMITTALS

- .1 Submit product data and Manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Division 01.
- .2 Submit WHMIS MSDS- Material Safety Data Sheets.
- .3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.5 SAMPLES

- .1 Submit colour sample chips of all paints to be used on this project in accordance with Division 01.

1.6 DELIVERY, HANDLING AND STORAGE

- .1 Observe and follow all Manufacturer's recommendations.
- .2 Deliver all materials in unopened original packages or containers of a suitable size for the particular application. Use without alteration of any kind, except where specifically recommended by the Manufacturer and with the Engineer's approval.
- .3 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .4 Fire safety requirements:
 - .1 Provide proper fire extinguisher adjacent to work site area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with proper Waste Management and Disposal techniques.
- .2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal.

- .3 Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .4 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .5 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .6 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil-soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
 - .6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
 - .7 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection for verifiable re-use or re-manufacturing.
 - .8 Close and seal tightly partly used sealant and adhesive containers, and store protected in well ventilated fire-safe area at moderate temperature.

1.8 ITEMS TO BE PAINTED

- .1 All piping, mechanical and electrical equipment not prefinished and as directed. This includes sleeves through floors and miscellaneous metals.
- .2 Interior wall repair to be painted white to match existing:
 - .1 Finished repair are of north wall to match existing wall finish.
- .3 Ceiling to be painted white to match existing.
- .4 PVC, HDPE, copper pipe, stainless steel, fibreglass, electrical conduit and galvanized cable trays are not to be painted unless directed.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems shall be products of a single Manufacturer.

2.2 STANDARDS AND QUALIFICATIONS

- .1 Conform to requirements of the latest edition of the Canadian Painting Contractors Association (CPCA) Manual and to CGSB 1-GP "Guide to the Selection of Paint Specifications on Use Basis".
- .2 For submerged surfaces, internal or external use only products approved for use in contact with potable water by one or more of the following:
 - .1 Health and Welfare Canada.
 - .2 American Water Works Association.
 - .3 United States Environmental Protection Agency.
 - .4 National Sanitation Foundation.
- .3 Use only products/Manufacturers listed in the CPCA Manual unless specifically approved otherwise.

2.3 COLOURS

- .1 Match colour schedule exactly. The nearest match of a standard line will not be accepted:
 - .1 Miscellaneous metal and pipe supports black CGSB 512-101.
 - .2 Valve hand wheels and operating levers red CGSB 509-103.
 - .3 Ceiling and interior wall repair white to match existing
 - .4 Roof, cladding, soffit, flashing, eavestrough, downspout, and trip: to match existing.

2.4 MIXING AND TINTING

- .1 Paint shall be mixed to the directions of its Manufacturer.

2.5 GLOSS/SHEEN RATINGS

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

<u>Gloss Level Category</u>	<u>Units @ 60°</u>	<u>Units @ 85°</u>
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	>85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein.

2.6 PAINT SYSTEMS

- .1 Steel and iron piping and equipment:
 - .1 Finished dry film thickness shall be 300 microns (12 mils).

- .2 Approved products:
 - .1 Bar-Rust 233H by ICI Devoe.
 - .2 Amercoat 395FD by General Paints.
- .2 Galvanized miscellaneous metals (in exposed locations):
 - .1 No coating required.
- .3 Ferrous metals (not listed above):
 - .1 Prime - Alkyd anti-corrosive primer.
 - .2 Intermediate - Alkyd-oil base, semi-gloss.
 - .3 Finish - Alkyd-oil base, semi-gloss.
- .4 Walls/ceiling-interior:
 - .1 Minimum: two final coats.
 - .2 Gloss/sheen: to match existing.
 - .3 Approved products:
 - .1 Devflex 4020- primer by ICI Devoe.
 - .2 Devflex 4206 -final coat by ICI Devoe.

Part 3 Execution

3.1 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint Manufacturer's written application instructions.

3.2 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Engineer.
- .2 Protect items that are permanently attached such as equipment nameplates and Fire Labels on doors or frames.
- .3 Protect factory finished products and equipment.
- .4 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and reinstalled after painting is completed by General Contractor.
- .5 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

- .6 As painting operations progress, place "WET PAINT" signs in prominent locations until paint is dry.

3.3 CLEANING AND PREPARATION

- .1 Preparation of iron and steel surfaces:
 - .1 Iron and steel surfaces that are not galvanized and will be subject to normal exterior or interior atmospheric exposure: Clean either in the shop or in the field by means of solvents, emulsions, cleaning compounds, steam cleaning, or similar materials or methods to the specifications issued by the Steel Structures Painting Council, SSPC-SP1. After solvent cleaning, blast the metal with abrasives to standards specified by SSPC-SP6 or CGSB 31-GP-404, Type 2. Prime cleaned surfaces as soon as practicable after cleaning with the appropriate specified primer. Prior to applying subsequent coats, clean and reprime all welds and other damaged areas of shop primed surfaces. Neutralize and remove all slag and weld spatter by acid washing.
 - .2 Submerged exposures: All iron and steel surfaces that are not galvanized and will be subject to immersion, or which will be wet by spray or condensation, or as specified in the schedule: clean of all rust, millscale and other foreign matter to bright base metal by solvent cleaning to specification SSPC-SP1 issued by the Steel Structures Painting Council and then blast cleaning to Standard SSPC-SP10 to CGSB 31-GP-404 Type 1. Carry out blast cleaning using abrasives of such particular shape, hardness and gradation as to effectively clean the metal and leave a roughened surface suitable for adequate bonding of subsequent coatings. As soon after cleaning as practicable, and prior to the formation of any corrosion from atmospheric moisture or other causes, clean all blast-cleaned metal surfaces of dust and coat with the specified primer, protective coating, or paint. Do not leave blast cleaned surfaces overnight prior to receiving the priming coat. Where manufacturer's requirements for surface preparation are more stringent than the foregoing. The Manufacturer's requirement shall be followed.
 - .3 Prior to field application of subsequent coats, thoroughly clean the surfaces of shop applied coating with mineral spirits.
 - .4 Properly clean all welds or other unpainted areas as specified for the adjacent area. Give one coat of primer as specified.

3.4 APPLICATION

- .1 Sand and dust between each coat to remove defects visible from a distance up to 1500 mm.
- .2 Finish tops, bottoms, edges and areas not readily visible.
- .3 Apply each coat as recommended by the Manufacturer.

3.5 PIPE MARKING

- .1 Apply directional flow arrows on all exposed piping 20 mm or larger at maximum 3.0 m intervals. Arrows to be black on yellow background roll mounted directional arrow tape.

3.6 FIELD QUALITY CONTROL

- .1 Field inspection of painting operations to be carried out by the Engineer or designate.
- .2 Advise Engineer when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

3.7 TOUCH-UP

- .1 Inspect all areas of work for damage.
- .2 Remove all splattering, finger marks, rust, water marks, scratches or blemishes.
- .3 Touch-up damaged or cleaned areas to leave whole job in perfect condition.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 The requirements of this section pertain to building mechanical systems and equipment for building operation included in Divisions 20 and 23 and on mechanical Drawings. Requirements for process and civil mechanical systems and equipment are not included in this section or Divisions 20 and 23.
- .2 Provide complete, fully tested and operational building mechanical systems to meet the requirements described herein and in complete accord with applicable codes and ordinances. This Contractor shall make provisions for labour, material and equipment necessary to complete the mechanical Work.
- .3 Contract Documents of this division are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.
- .4 Conform to manufacturer's instructions, details and procedures for equipment installations while adhering to code requirements. Installation requirements shall be supplemented by the requirements of Contract Documents. Provide all necessary equipment to complete system installation.
- .5 Install equipment generally in locations and routes shown, close to building structure and with minimum interference with other services or free space. Remove and replace improperly installed equipment.
- .6 Contractor is to ensure that all intended equipment will fit within given spaces. Make reference to the electrical, mechanical, architectural and structural Drawings, when setting out work and before ordering equipment.

1.2 SCOPE OF WORK

- .1 Supply, install, and make operational, the following complete mechanical systems:
 - .1 Heating.
 - .2 Ventilation.
- .2 Coordinate all electrical requirements with electrical Subcontractor.
- .3 Coordinate all controls requirements with electrical Subcontractor.
- .4 Coordinate all wall and roof penetration requirements with framers, structural steel installers, cladding installers, and masons.

1.3 REFERENCE STANDARDS

- .1 All referenced standards in the Division specification sections shall be to the latest applicable edition including all addenda.

- .2 All Work shall conform to current edition of National, Provincial and Municipal Codes, Regulations, Standards and Acts.
- .3 All Work shall satisfy the requirements of the Authority Having Jurisdiction (AHJ).
- .4 All Work shall be installed in accordance with but not be limited to the listed editions or latest approved editions of:

1.4 REGULATIONS

- .1 All Work shall conform to current edition of National, Provincial and Municipal Codes, Regulations, Standards and Acts.
- .2 All Work shall satisfy the requirements of the Authority Having Jurisdiction (AHJ).
- .3 All Work shall be installed in accordance with but not be limited to the listed editions or latest approved editions of:
 - .1 The Saskatchewan Employment Act and Occupational Health and Safety Regulations.
- .4 National Building Code of Canada (NBC).
 - .1 Canadian Electrical Code - Part 1 (CSA-C22.1).
 - .2 2021 Canadian Electrical Code Saskatchewan Interpretations.
 - .3 Occupational Health and Safety (OH&S) Act, Regulation and Code.
 - .4 SMACNA Standards.
 - .5 Workers' Compensation Board (WCB).
 - .6 Local/Municipal/City By-Laws.
 - .7 Codes, Standards and Regulations mentioned elsewhere in these Contract Documents.

1.5 QUALITY ASSURANCE

- .1 Work performed under Divisions 20 and 23 must be carried out by licensed tradesmen regularly employed and experienced with the type of work being installed under the Contract.
- .2 The Contractor shall belong to the Mechanical Contractors Association of the Province the work is being performed in.
- .3 All welders must be licensed by Provincial authorities.
- .4 Work performed on pressure piping systems 103 kPa (15 PSI) and greater must be performed by licensed steamfitters/pipefitters.

1.6 EXAMINATION OF SITE

- .1 This project involves building renovations. Therefore, careful examination of the Project Site and local conditions will be required to determine the difficulties in carrying out the work indicated. Existing mechanical systems illustrated on Drawings shall not be construed as "as-built". Contractor shall notify Engineer of differences between Drawings and site prior to final tender for inclusion in any addendum issued.
- .2 Contractor shall allow for variations of existing mechanical systems illustrated prior to submitting final price. Extras will not be considered based on differences on Project Site.

1.7 METRIC CONVERSIONS

- .1 All specified units of measurement under this Division are expressed in SI units.
- .2 Submit Shop Drawings and operation and maintenance manuals in SI units.
- .3 Use the same SI units specified in the Specifications and Drawings on submittals, Shop Drawings and product data.
- .4 All whole-number inch designations convert to multiples of 25 mm for ductwork.
- .5 Pipe size from 2" through to 60", conversion based on CSA standard Z245.1. Pipe size 2" and smaller, conversion based on European ISO standard. Other pipe sizes are U.S. Conversions to the metric system.

Nominal Pipe Sizes	
Imperial (Inches)	Metric (mm)
$\frac{1}{8}$	6
$\frac{1}{4}$	8
$\frac{3}{8}$	10
$\frac{1}{2}$	15
$\frac{3}{4}$	20
1	25
$1\frac{1}{4}$	32
$1\frac{1}{2}$	40
2	50
$2\frac{1}{2}$	65
3	80
$3\frac{1}{2}$	90
4	100
5	125
6	150
8	200
10	250
12	300
14	350

1.8 STANDARD OF MATERIALS

- .1 The Standards Council of Canada provides accreditation to testing organizations that may certify products that are acceptable in Canada. All products/equipment/components shall be certified by an accredited organization in North America and bear the mark(s) that are acceptable in Canada. This shall include but not limited to CSA and ULC.
- .2 The performance rating of equipment shall be certified by an independent third party:
 - .1 Equipment supplied for air-conditioning, heating, and refrigeration shall be tested, certified and labelled by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI).
 - .2 Fans shall conform to Air Movement and Control Association (AMCA) bulletins regarding construction and testing, and equipment shall bear AMCA certified rating seal.
- .3 Make and quality of materials used are subject to approval by the Engineer. This Contractor shall remove unacceptable materials and install suitable materials in their place.
- .4 Materials and equipment installed shall be new, full weight and of quality specified. Use consistent brand or manufacturer for each specific application whenever possible.
- .5 Each major component of equipment shall bear unit tag number, Manufacturer's name, model number, serial number, and date of manufacture in a conspicuous place.

1.9 SHOP DRAWINGS

- .1 Submit Shop Drawings to Engineer on all equipment specified for review. Do not order equipment or material until Shop Drawing has been reviewed as acceptable and returned.
- .2 Identify materials and equipment by Manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Operation and maintenance (O&M) manuals are not suitable Shop Drawing submittal material.
- .3 Clearly mark submittal material using arrows, underlining or circling to show differences from that specified (i.e., ratings, capacities and options being proposed). Cross out non-applicable material. Specifically note on the submittal all specified optional/extra features and accessories.
- .4 Include dimensional and technical data sufficient to check if equipment meets requirements.
- .5 Indicate on Drawings:
 - .1 Equipment tags numbers.
 - .2 Performance data.
 - .3 Dimensions, weights, and access requirements.
 - .4 Construction details.
 - .5 Piping and ductwork connections, locations, and sizes.
 - .6 Mounting arrangements.

- .7 Operating and maintenance clearances.
- .8 Motor sizes.
- .9 Wiring diagrams.
- .10 Piping, and service connection data.
- .6 Shop Drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
 - .6 Detailed drawings of seismic control measures.
- .7 In the case of product with different layout and arrangement is reviewed, Contractor shall take responsibility to modify building, piping, ductwork, power connection, control wiring, control software and/or accessories to meet design intent in the drawings and specification with no extra cost and construction time.

1.10 ALTERNATIVE MATERIALS AND EQUIPMENT

- .1 Contract Documents are based on specified materials and equipment and indicated standards of acceptance and design basis. All materials and equipment complying with the specifications and equivalent to the standard of acceptance or design basis are acceptable
- .2 Refer to Divisions 00 and 01 of the Contract Document for requirements pertaining to product options and substitutions. Proposals for alternatives shall include details of any revisions necessary to accommodate same. No increase in the contract price shall be considered.
- .3 Installed materials and equipment shall meet specified requirements regardless of whether or not Shop Drawings are reviewed by the Owner.
- .4 Contract revisions resulting from alternatives shall be included in the contract price. No increase in the contract price or extension of the schedule will be considered to accommodate the use of equipment other than that specified.
- .5 In the case of alternate product or product with different layout, arrangement, or characteristic than the standard of acceptance or design basis, Contractor shall take responsibility to modify piping, ductwork, building elements, power connection, control wiring, control software and/or accessories to meet design intent in the Drawings and Specification with no extra cost and construction time.

1.11 SCHEDULING

- .1 Installation of Work shall be coordinated with the General Contractor and scheduled so as not to endanger or disturb the Owner or the public or users of the existing facility.

1.12 TEMPORARY OR TRIAL USAGE

- .1 Do not use the permanent building mechanical systems for temporary heating purposes without written permission from the Engineer.
- .2 The Contractor is responsible for all heating costs during construction.
- .3 Owner may use equipment and systems for test purposes prior to acceptance. Temporary or trial usage by the Owner of mechanical equipment supplied under contract shall not represent acceptance.
- .4 Use of permanent systems for temporary heat shall not modify terms of warranty.
- .5 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company system.

1.13 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused metal and wiring materials from landfill to metal recycling facility.
- .2 Dispose of unused paint, oil, grease, chemicals and other hazardous materials at official hazardous material collections site. Do not dispose material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.
- .3 Place packaging material in appropriate on-site bin for recycling in accordance with the Project Site waste management program. Send packaging materials to appropriate recycling facilities.

1.14 IDENTIFICATION

- .1 Equipment:
 - .1 Identify equipment (including electric motors) with nameplates showing the size, performance, name of equipment, serial number, model number, V/Ph/Hz of power supply, horsepower of motors, and the name of the Manufacturer and their address.
 - .2 Include registration plates (i.e., pressure vessel, ULC and CSA approval plates) as required by respective agency and as specified.
 - .3 Identify electric starting switches, thermostats controlling motors and equipment supplied under this Division.
 - .4 Provide identification on each piece of equipment with Lamacoid label to match equipment tag used in Contract Documents.
 - .5 Lamacoid labels shall have a minimum size of 87 mm × 32 mm × 2.3 mm (3½" × 1½" × 3/32") with standard 6mm (¼") high engraved lettering for most equipment. Use 25 mm (1") high lettering for large equipment such as chillers, condensers, air handling units, and tanks. For hot equipment, such as boilers, furnaces and heat exchangers, provide engraved brass or bronze plates with black paint filled identification.

- .6 Coordinate with controls Contractor and obtain list of automatically operated equipment and provide warning identification on Lamacoid plate for each item as follows:
 - .1 “Warning: This equipment may start at any time. Do not service without disconnecting power.”
- .7 Where equipment is locally switched (i.e., room exhaust fans) provide identification plate at switch.
- .8 Fix Lamacoid labels to equipment using pop rivets or sheet metal screws.

1.15 CLOSEOUT SUBMITTALS

- .1 Operation and maintenance data: submit the following operation and maintenance data for incorporation into manual in accordance with Section 01 78 23 - Operating and Maintenance Data.
 - .1 Operation and maintenance manual approved by, and final copies deposited with Owner/Engineer before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Colour coding chart.
 - .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation, and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .4 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
 - .5 Record drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right-hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Owner/Engineer for approval and make corrections as directed.
 - .4 Perform testing, adjusting, and balancing for HVAC, using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.16 TESTING

- .1 Test equipment and materials where specified or required by authorities having jurisdiction to demonstrate proper and safe operation. Provide notice of testing plans to Engineer prior to conducting tests.
- .2 Test procedures shall be in accordance with applicable portions of the National Plumbing Code of Canada, ASHRAE, SMACNA, NFPA, CSA and other recognized test Codes as far as field conditions permit.
- .3 Submit test reports to Engineer for review.
- .4 Should test results reveal that equipment does not meet specified performance requirements, equipment will be rejected, and the following shall apply:
 - .1 Remove rejected equipment. Replace with equipment that meets requirements of Contract Documents including specified performance requirements.
 - .2 Replacement equipment will also be subject to performance verification, using same testing procedures on originally installed equipment.
 - .3 Contractor shall pay all costs resulting from performance verification procedure.

Part 2 Products

Not used.

Part 3 Execution

3.1 GENERAL

- .1 Install equipment, ductwork, wiring, conduit, piping, and all other portions of the Work in a workmanlike manner to present a neat appearance and to function properly to the acceptance of the Engineer. Install ducts, wiring, equipment, and piping parallel and perpendicular to building planes. Install exposed systems neatly and group to present a neat appearance. Comply with Manufacturer's installation requirements unless superseded by Code requirements.
- .2 Follow safe work procedures for all aspects of this project. During welding or soldering procedures, provide a fire-retardant cloth, mat or blanket to protect the structure, and adequate fire protection equipment at all locations where work is being done. Close off shafts or confined areas with a fire-retardant mat or cloth to prevent sparks or pieces of hot metal from falling down the shaft or areaway.
- .3 Install all equipment and apparatus with adequate service space allowance for wiring, maintenance, adjustment or eventual replacement.
- .4 Install control devices to ensure proper sensing. Shield elements from direct exposure to sunlight, heat, or cold which may skew measurements. Avoid placing devices behind obstructions.
- .5 Replace all Work unsatisfactory to the Engineer without extra cost.

- .6 Leave space clear and install all Work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or materials supplied by other trades. Verify available space in which Work shall be performed. Install mechanical systems to maintain maximum headroom and clearances.

3.2 SCREWS, BOLTS AND FASTENERS

- .1 Use 316 stainless steel, ASTM commercial sizes and patterns for all nuts, bolts, and washers.
- .2 Use heavy hex heads, semi-finished unless otherwise specified.
- .3 Bolts used on fan equipment for access to motors, bearings, filters and the like shall be heavy-duty.
- .4 Bolts shall not project more than one diameter beyond nuts.
- .5 Use standard washers on equipment, sheet metal and soft gaskets; lock type washers where vibration occurs.

3.3 PAINTING REPAIRS AND RESTORATION

- .1 Prime and paint all exposed ducts and pipes with colours to match interior finishes.
- .2 Prime and touch up marred finishes to match original.
- .3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.
- .4 Provide all exposed ferrous metal work and equipment with at least one prime coat. Clean up or wire brush all metal before prime coat and painting.
- .5 Coordinate with painting Subcontractor in identifying equipment and piping where required for colour coding, stencilling and the like. Provide all required assistance in identifying all piping circuits requiring colour coding in addition to propane piping.

3.4 GENERAL METALS

- .1 Steel construction required solely for the work of Mechanical Trades, where not shown on building or structural Drawings, shall be provided by this Contractor in compliance with structural Specifications and to the acceptance of the Engineer.
- .2 Material: galvanized unless indicated otherwise.
- .3 Miscellaneous metals provided by the mechanical Subcontractor shall be primed and ready for painting prior to installation.

3.5 SUPPORTS, BASES, PADS, PITS AND STANDS

- .1 Provide all structural Work required for installation of piping, fans, motors and other apparatus.

- .2 Supply and install all anchor bolts and fasteners.
- .3 Where not detailed elsewhere, mount equipment suspended above floor level on platform bracketed from wall or ceiling. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.
- .4 Fasten all supports to floor, studs, or joists. Where required for proper alignment, coordinate additional framing with framing installers or provide additional support members to span studs or joists.
- .5 All rotating and vibrating equipment shall receive vibration isolators.

3.6 GENERAL CLEARANCES

- .1 Provide a minimum 600 mm clearance on at least two sides of all systems, equipment, and components for observation of operation, inspection, servicing, maintenance and replacement. Provide additional clearance space in front of equipment access panels or doors and where equipment manufacturer instructions and/or Code requirements dictate.
- .2 Connection points (flanges, unions, etc.) shall be installed such that devices can be removed when connection is broken without additional disassembly.
- .3 Provide a minimum 1,000 mm clearance in front of all electrical and control panels.

3.7 EQUIPMENT CONNECTIONS

- .1 Install flexible duct connections for all ductwork connecting to fans and to all mechanical equipment equipped with fans. Flexible duct connections shall be installed on all intake and discharge connections.
- .2 Install piping connections to equipment without strain at the pipe connections.
- .3 Install flexible pipe connections for all pipe connection to rotating/moving equipment.

3.8 EQUIPMENT GUARDS

- .1 Meet safety requirements of The Saskatchewan Employment Act and Occupational Health and Safety Regulations, 2020, OH&S, and local authority having jurisdiction.
- .2 Guards for drives shall be removable for servicing.
- .3 For flexible pipe couplings to rotating equipment, provide a 2.5 mm galvanized removable "U" shaped frame with 1.2 mm expanded mesh face.
- .4 Provide means to permit lubrication and use of test instruments with guards in place.
- .5 Install belt guards to permit movement of motors for adjusting belt tension.
- .6 Provide 19.05 mm (¾") mesh wire screen on inlet or outlet of exposed fan blades.

3.9 CUTTING AND PATCHING

- .1 This Contractor shall be responsible for:
 - .1 Identifying and coordinating all openings and holes required for the passage of mechanical systems through structures and dividing walls.
 - .2 The supply of all sleeves required to be built in for the routing of mechanical services.
 - .3 Cutting and fitting required to complete mechanical Work.
 - .4 Installation of expansion bolts, hanger rods, brackets, and supports.
- .2 The General Contractor shall be responsible for cutting, coring and patching of the structure.
- .3 Give timely notice concerning required openings. Coordinate cutting and patching of existing and/or finished areas with the General Contractor.
- .4 X-ray use for locating in-floor rebars and conduit shall be arranged by the General Contractor.
- .5 Relocate improperly located holes and sleeves.
- .6 Seal around services passing through cut openings with materials suitable to achieve the fire rating of the wall, floor or roof. Ensure sealing is weatherproof for openings through exterior surfaces. Before sealing, provide prime coat of paint on all repaired surfaces.

3.10 CURBS AND FLASHING

- .1 Provide curbs, flashing and counter flashing where mechanical systems pass through weather or waterproofed walls, floors and roofs. Flashing shall provide a waterproof barrier.
- .2 Allow for expansion and contraction of pipe.

3.11 SYSTEM START-UP

- .1 General: perform start-up operations in accordance with Section 01 75 01 - Pre-Start-Up, Start-Up, and Commissioning, supplemented as specified herein.

3.12 DEMONSTRATION

- .1 Owner/Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, troubleshooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio-visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

- .5 Contractor will record these demonstrations on video tape for future reference.

3.13 CLEANING

- .1 Progress cleaning: clean in accordance with Section 01 10 00 - General Requirements:
 - .1 Leave Work area clean at end of each day.
- .2 Final cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 23 - Final Cleaning.

3.14 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.
- .2 Protect installed products and components from damage during construction. Repair damage to new or existing products, materials, and components during construction.

3.15 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests and submit reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Manufacturer's field services:
 - .1 Obtain written report from Manufacturer verifying compliance of Work, in handling, installing, applying, protecting, and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide Manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with Manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 20 05 01.01 - Building Mechanical - General Requirements.

1.2 REFERENCE STANDARDS

- .1 ASTM International:
 - .1 ASTM A125, Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563, Standard Specification for Carbon and Alloy Steel Nuts.
- .2 Factory Mutual (FM).
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS):
 - .1 MSS SP58, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .4 Underwriter's Laboratories of Canada (ULC).
- .5 Duct hangers shall follow the recommendations of the SMACNA Duct Manuals.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.
- .2 Product data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit Shop Drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' instructions:
 - .1 Provide Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01.01 - Building Mechanical - General Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements and with manufacturer's written instructions.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Design requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance requirements:
 - .1 Design supports and hangers to withstand seismic events in accordance with National Building Code of Canada for post-disaster buildings. Refer to structural Drawings for location spectral information.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58 and ANSI B31.1.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.
- .3 Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, provide for expansion and contraction and to accommodate insulation; provide insulation protection saddles.
- .4 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
- .5 Select hangers and supports for the service and in accordance with the Manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- .6 Fasten hangers and supports to building steel or inserts in concrete construction.

- .7 Provide and set sleeves required for equipment, including openings required for placing equipment.
- .8 Dielectrically isolate dissimilar metals.

2.3 HANGER RODS

- .1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.
- .2 Ensure that hanger rods are subject to tensile loading only.

2.4 FLASHING

- .1 Steel flashing: 0.55 mm galvanized steel.
- .2 Safes: 25 kg/m² sheet lead or 200 micrometre neoprene.
- .3 Caps: steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.5 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrication. Submit calculations with Shop Drawings.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.7 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Division 05.
- .2 Submit structural calculations with Shop Drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with Manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Use approved constant support type hangers where:
 - .1 Vertical movement of pipework is 13 mm or more.
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.

- .3 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25% of total load.

3.3 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.

3.4 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.

3.5 FLASHING

- .1 Flash and counter-flash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate:
 - .1 Operators.
 - .2 Thermal properties.
 - .3 Leakage.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.
- .2 Operation and maintenance data: submit operation and maintenance data for incorporation into manual.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra materials:
 - .1 Submit maintenance materials in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.
- .2 Delivery and acceptance requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Products

2.1 INSULATED DAMPERS

- .1 Frame: extruded aluminum 101 mm deep and not less than 2.03 mm thick.
- .2 Entire frame is to be thermally broken by means of polyurethane resin pockets, complete with thermal cuts.

- .3 Blades: thermally broken extruded aluminum profiles, internally insulated with expanded polyurethane foam. Complete blade is to have an insulating factor of R-2.29.
- .4 Seals: extruded, low-temperature silicone, flexible down to -73°C, secured in an integral slot within the aluminum extrusions.
- .5 Bearings: acetal copolymer inner bearing fixed to a 11.11 mm aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, (no metal-to-metal or metal-to-plastic contact).
- .6 Linkage hardware to be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
- .7 Operator shaft: 13 mm (½”), zinc plated steel.
- .8 Operator: hand locking quadrant for manual damper operation.
- .9 Leakage is not to exceed 15.2 l/s/m² .25 kPa. w.g. differential static pressure.
- .10 Pressure drop of a fully open 1220 mm x 1220 mm damper is not to exceed 0.004 kPa. at 5.08 m/s.
- .11 Dampers to be made to size required without blanking off free area.
- .12 Dampers shall be opposed blade action or parallel blade action as indicated.
- .13 Dampers shall be installed in duct or flanged to duct type as indicated.
- .14 Dampers are to be designed for operation in temperatures ranging between -73°C and 85°C.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

- .1 General: install in accordance with recommendations of SMACNA and Manufacturer's instructions.
- .2 Operating dampers:
 - .1 Seal multiple damper modules with silicon sealant.
 - .1 Seal insulated dampers to the wall penetration.
 - .2 Ensure dampers are observable and accessible.
 - .3 Ensure dampers are installed with proper alignment and blades seal completely to each other and the frame when fully closed.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 20 05 01.01 - Building Mechanical - General Requirements.

1.2 REFERENCE STANDARDS

- .1 ASTM International:
 - .1 ASTM E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 20.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Noise criteria.
 - .3 Pressure drop.
 - .4 Face area.
 - .5 Free area.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.
- .2 Operation and maintenance data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Manufacturer's written instructions and Section 20 05 01.01 - Building Mechanical - General Requirements.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Refer to equipment schedules on Drawings.

2.2 SYSTEM DESCRIPTION

- .1 Performance requirements:
 - .1 Catalogued or published ratings for manufactured items: Obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.3 GENERAL

- .1 Type as indicated to meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Base air outlet application on space noise level of NC 35 maximum.
- .3 Frames:
 - .1 Full perimeter gaskets.
 - .2 Concealed fasteners.
- .4 Concealed manual volume control damper operators as indicated.

2.4 FIXED LOUVRES - ALUMINUM

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy.
- .3 Blade: 2 mm thick, 35 ° angle, drainable pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1,500 mm.
- .4 Frame, head, sill and jamb: channel frame, 152 mm deep 1-piece extruded aluminum, minimum 2 mm thick with approved caulking slot, integral to unit.
- .5 Screen: 12 mm exhaust 19 mm intake mesh, 2 mm diameter wire aluminum bird-screen on inside face of louvres in formed U frame.
- .6 Finish: factory applied enamel, colour to match door trim.
- .7 Size: as indicated with free area velocity below beginning point of water penetration.
- .8 Accepted alternates must meet requirements for water penetration and pressure drop at indicated size and airflow.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with Manufacturer's written instructions.

3.2 INSTALLATION

- .1 Install in accordance with Manufacturer's instructions.

- .2 Positions indicated on Drawings are approximate only. Check location of outlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 20 05 01.01 - Building Mechanical - General Requirements.

1.2 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International):
 - .1 CSA C22.2 No.46, Electric Air-Heaters.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.
- .2 Product data:
 - .1 Submit Manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Manufacturer's instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements.
- .2 Operation and maintenance data: submit operation and maintenance data for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 20 05 01.01 - Building Mechanical - General Requirements and with Manufacturer's written instructions.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Refer to equipment schedules on Drawings.

2.2 UNIT HEATERS

- .1 Standard of Acceptance: Ouellet OAS.
- .2 CSA approved unit heaters.
- .3 Standard color: almond. Finish: standard: epoxy/polyester powder paint.
- .4 Cabinet: suspended type, 18 and 20-gauge steel (1.2 and 0.9 mm) steel with rounded exposed corners and edges. Adjustable louvers to direct air flow.

- .5 Fan: totally enclosed factory-lubricated ball bearing motor. Thermally protected motor mounted in cold compartment. Fan delay purges heater of residual heat.
- .6 Electric coils: tubular heating elements; stainless steel (2 to 10 kW); finned steel (15 to 60 kW).
- .7 Control: 24 V relay with transformer, remote wall thermostat.
- .8 Ceiling brackets.
- .9 Disconnect switch.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for equipment installation in accordance with Manufacturer's written instructions.

3.2 INSTALLATION

- .1 Install heaters in accordance with Manufacturer's written recommendations.
- .2 Make power and control connections.
- .3 Install thermostats where indicated and 1.2 m above floor. Supply heat shields where recommended by Manufacturer. On exterior walls and walls adjacent to unheated spaces and water and wastewater reservoirs, mount thermostats on bracket or 25 mm insulated pad.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Division 26.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This section refers to the communications, control, and instrumentation elements of the project.

1.2 RELATED SECTIONS

- .1 Division 26.
- .2 Appendix A - Process Control Narrative
- .3 Appendix B - I/O List

1.3 FUNCTIONAL REQUIREMENTS

- .1 These Specifications are intended to define the minimum system requirements. The functional requirements of the system shall take precedence over all other information contained in this Division.
- .2 It is not the intent of this Specification to completely specify all details of design and construction. Suggested changes to these Specifications to improve the installation operation or to effect economy of fabrication at no sacrifice in performance will be considered, provided suitable notation is made.
- .3 The selections of all accessories, Materials, and methods of fabrication not specifically covered by these Specifications but which are necessary to complete the fabrication of the instrumentation and control systems, shall be the responsibility of the vendor and shall be carried out in accordance with good engineering practices:
 - .1 In the event of a conflict between this Specification and accompanying supplementary documents, the latter shall take precedence.
- .4 The Drawings are intended to show the major details of the control and instrumentation Work, but it shall be the Contractor's responsibility to examine the existing electrical, process, mechanical, structural, and architectural detail at site before beginning the Work and report to the Engineer any discrepancies or interferences which exist. No deviations shall be made from the Specifications without prior written permission from the engineer. All deviations from the Specifications must be identified in writing at time of submission.
- .5 Control and instrumentation system layouts shown on the Drawings are generally diagrammatic, and the locations of equipment are approximate. Exact routing of conduits, cables, wiring, tubing, and air headers shall be governed by the process, mechanical, structural, and architectural conditions which prevail. The Contractor is responsible for making all required control and instrumentation connections to equipment supplied under this contract. The control and instrumentation Work is to be installed consistent with the architectural, process, mechanical and/or structural conditions that exist at site.
- .6 The Engineer reserves the right to change the location of any piece of equipment without extra payment thereof, provided that the change is requested before installation and that the new location is within 3.0 m of the original location.

1.4 WORK INCLUDED

- .1 The Work to be carried out for RWPH shall include the following:
 - .1 ACP-970 - Main PLC Panel:
 - .1 Supply and install of new ACP-970 control panel including all components.
 - .2 Supply, installation, configuration, and commissioning of instruments and the associated wiring.
 - .3 Supply, install, and commission all terminals including field instrument power and control wiring to all devices within the RWPH. Include all wiring with conduit or cable tray for signal wiring from the existing building equipment to the new control panel.
 - .4 Supply, install, configure and commission networking equipment as shown.
 - .5 Supply, installation, coordination with owner of devices for alarm dialing and remote support access including any telephone plans, accessories, and services.
 - .2 Coordination with Owner and SaskTel to abandon existing leased communication lines between WTP and RWPH.
 - .3 PLC, SCADA, and HMI programming to be completed by ATAP Infrastructure Management. Contact James Johnston, 306-222-6143 or Paul Botari 306-808-3044 for pricing. Contractor shall coordinate all testing and commissioning activities.

1.5 SUBMITTALS

- .1 Shop Drawings, product data and samples are to be submitted to the Engineer, as specified elsewhere, and generally include:
 - .1 Scaled dimensions.
 - .2 Construction configurations and materials.
 - .3 Mounting details and heights.
 - .4 Complete performance and operating characteristics.
 - .5 Power and control schematics.
 - .6 PLC module wiring from I/O point to field device.
 - .7 Communications wiring diagrams including pin outs of connectors.
 - .8 Complete bill of materials.
 - .9 Identify all equipment with exact reference to those used in the contract documents.
 - .10 HMI screenshots.
 - .11 An electronic copy of the PLC code with documentation and no password protected areas. All user defined blocks are to be provided.
 - .12 PLC process description.
 - .13 The searchable pdf version of final PCN including all changes, set points and alarms implemented during the construction and commissioning.

- .2 Internal panel device layouts are not shown in detail. Areas are defined for major panel equipment, and field I/O terminals. Final placement of all internal components is the Contractor's responsibility based on the guidelines provided by the equipment Manufacturer.
- .3 The Contractor will mark up two sets of redlines on a daily basis showing all deviations from the Drawings. These sets will be available for inspection by the Owner or Owner's Representative at any time during construction. Upon completion of the job, forward one set to the Engineer for record Drawing purposes and leave one set on site.

1.6 TESTING AND CALIBRATION

- .1 Field calibrate and adjust all elements to the Specifications as provided by the Engineer during construction.
- .2 Document all testing and calibration on record sheets recording the results and dates of all tests required and performed. Include in operating and maintenance manuals.
- .3 Perform continuity checks on all wiring.
- .4 Testing is to include operation of all field instruments and devices by actuation of their controlling variable where possible (e.g., pressure switches, transmitters, hand-switches, etc.) and monitoring of received signals at the control panels before engaging the integrator to verify I/O. Similarly, panel outputs to field drives and devices are to be verified by operation of manual mode controls at the control panels. Any rotating equipment or valves, etc., which can not be safely energized by testing of discrete panel outputs, are to be temporarily disconnected, and potential or continuity checks of the output circuits made while energized.

1.7 QUALIFICATIONS

- .1 The Work as specified in this division shall be performed by a competent control and instrumentation contractor, specializing in instrumentation and control Work, and normally employing instrumentation journeymen.

1.8 APPROVAL OF ALTERNATIVES

- .1 All materials and equipment specifically noted by trade name, shall be considered as the standard of quality required. All tenders are to carry, as part of their total tender price, all control and instrumentation system equipment identified as approved hardware.
- .2 No deviation from the Specifications will be allowed without prior written permission from the Engineer.

1.9 CUTTING AND PATCHING

- .1 No structural members or process piping shall be cut, notched, or drilled without written permission from the Engineer.
- .2 All cutting, drilling, and patching shall be carried out by qualified tradesmen.
- .3 All finished surfaces to be approved by the Engineer.

1.10 BRACKETS AND SUPPORTS

- .1 Provide all necessary brackets and supports for mounting equipment required for the Work.
- .2 Method of attachment to structural surfaces shall be approved by the Engineer.

1.11 PROTECTION AND SECURITY

- .1 Protect all exposed live equipment and wiring during construction from damage and for personnel safety.
- .2 Provide warning signs and security precautions necessary to alert and protect authorized representatives of the Client, Engineer and authorities having jurisdiction.

1.12 MANUFACTURER'S INSTRUCTIONS

- .1 The Contractor is responsible for the correct installation and assembly of all items of equipment. Manufacturer's instructions are to be carefully read and rigidly adhered to in the installation. Any damage resulting from failure to observe the Manufacturer's instructions or as a result of proceeding with the Work without complete knowledge of a particular component, will be the Contractor's responsibility. Make good any loss or damage resulting from malpractice.

1.13 COORDINATION OF THE WORK

- .1 Coordinate all requirements with other trades for all openings, anchors, hangers, or other provisions for the installation of the Work in ample time so that proper provision can be made. Additional costs due to failure to comply with this requirement will be the Contractor's responsibility.
- .2 Coordinate the Work to ensure that:
 - .1 All components provided under this section are properly installed.
 - .2 The proper type, size and number of control and instrumentation cables are provided and installed.
 - .3 Proper electric power circuits are provided for all components and systems.

1.14 OPERATION AND MAINTENANCE MANUALS

- .1 Provide copies of operating and maintenance manuals to the Consultant at completion of Work as specified. In addition to requirements specified elsewhere, the manuals shall include:
 - .1 Trouble-shooting instructions.
 - .2 Technical product data with sizes, options, modifications, and assembly for specific equipment installed (advertising or sales literature not acceptable).
 - .3 Certified copies of all testing and commissioning results.
 - .4 Manufacturers data sheets, installation manuals and parts lists for all panel elements.
 - .5 Drawings detailing control equipment dip switch settings.
 - .6 Data sheets showing as-built parameter settings of configurable instruments and devices.

1.15 SPARE PARTS AND SPECIAL TOOLS

- .1 As specified elsewhere, supply a list of recommended spares.
- .2 To enable functional testing and operation to be performed, a minimum supply of spare parts is to be provided, and include:
 - .1 One ethernet communication module as per drawing model number.
 - .2 One 16-point discrete input module as per drawing model number.
 - .3 One 16-point discrete output module as per drawing model number
 - .4 One 8-channel analog input module as per drawing model number.
 - .5 One 8 channel analog output module as per drawing model number.
 - .6 One 16-channel 120VAC discrete input module as per drawing model number.
 - .7 One 16-channel 120VAC discrete output module as per drawing model number.
 - .8 One ethernet switch (Refer to Part 2 - Products).
 - .9 One DC Power Supply (Refer to Part 2 - Products).
 - .10 One power filter (Refer to Part 2 - Products).
 - .11 Two replacement digital indicator displays of type used.
 - .12 Two replacement lamps of each type used.
 - .13 Ten control fuses of each type and rating used.

Part 2 Products

2.1 CONTROL WIRING

- .1 Refer to Division 26 for material and installation standards for all instrumentation wiring.
- .2 Refer to Division 26 for material and installation standards for all cabling, conduit, and fittings.
- .3 Wire identification shall be with typed heat-shrink wire markers, white colour with black numbers.
- .4 Each end of the wire must be marked with a consistent designator, preferably with both the ISA designation and the Terminal Block number they are attached to.
- .5 All panel wiring is to be neatly formed, tie-wrapped and frequently supported. A primary requirement will be neatness. No splices will be allowed. All wiring is to be installed continuously from terminal to terminal.
- .6 Each wire termination at a stud is to have a ring-type crimp-on connector. All wiring terminating at tubular screw terminals is to be stripped for full insertion into the terminal. Wiring termination at solder terminals is to be mechanically secure before solder is applied. Resin type solder is to be used.
- .7 Wire looms are to be secure and wire forming shall provide enough length to ensure that there will be no mechanical tension on wire terminations.
- .8 Mechanical checks are to be made to determine if there are any broken parts, wires, mechanical binding, loose screws, and proper soldered connections. Mechanical tolerances are to be checked on all units including contact grip and wires.

2.2 OUTLET, TERMINAL, AND JUNCTION BOXES

- .1 Refer to Division 26 for material and installation standards for all outlet, terminal, and junction boxes.

2.3 APPROVED MANUFACTURERS AND PANEL BUILDERS

- .1 Except as specified elsewhere, equipment is to be provided by the approved manufacturers for each instrument or element as listed in the Specification sheets following this section.
- .2 The equipment supplied must conform to the details described in the Specification sheets.
- .3 The intent for the control cabinet is to have an approved, bondable panel builder responsible for the control cabinet, instrumentation, and MCC interface, including commissioning. Approved panel builders are required to provide provincial and local support.
- .4 Approved panel builders must allow for factory acceptance testing by Engineer or Engineer's representative. Panel builder must provide minimum 2-weeks notice to Consultant when scheduling factory acceptance test.
- .5 Approved panel builders are:
 - .1 SE Panel Products.
 - .2 Indus Automation.
 - .3 Stockdales Electric.
 - .4 Delco Automation.
 - .5 Approved equal.

2.4 PANEL ENCLOSURES

- .1 Approved Manufacturers:
 - .1 Hammond Manufacturing.
 - .2 Hoffman.
 - .3 Rittal.
- .2 Panel enclosures are designated herein as follows:
 - .1 Small: less than 600 mm height by 600 mm width.
 - .2 Medium: 600 to 1220 mm height by 600 to 915 mm width.
 - .3 Large: greater than 1220 mm height by 915 mm width.
- .3 Enclosure classification:
 - .1 Process Areas and Outdoor: NEMA 4X rated, fabricated of 316 Stainless Steel.
 - .2 Electrical Room and Office Areas: NEMA 12 rated unless otherwise specifically noted.

Sized as indicated in Drawings or as required if not indicated.
- .4 All panels to be equipped with front access door, panels less than 1000 mm wide to be single door, larger panels to be double door unless otherwise indicated.

- .5 Enclosure to be complete with all instruments, meters, control switches, indicating lights, programmable control I/O modules, power supplies, wiring terminals and other devices as specified or shown in Drawings.
- .6 Enclosures wall thickness shall be as follows unless otherwise noted:
 - .1 Small wall mounted panels shall have steel thickness minimum 16 Ga.
 - .2 Medium wall mounted panels shall have steel thickness minimum 14 Ga.
 - .3 Large and/or free standing shall have steel thickness minimum 12 Ga.
- .7 The Panel-Builder shall produce a set of detailed control panel Drawings, sized 11" × 17", including but not limited to the following:
 - .1 Layout of front door, layout of interior back panel and bill of materials
 - .2 Communications cabling arrangement including details and pin-outs of any custom-made cables.
 - .3 Power distribution diagram including circuit breakers and fused terminal blocks.
 - .4 Wiring diagrams for each panel, showing wire numbers, colours, and terminal block numbers for all wiring internal to the panel and for interfaces and terminations to field devices.
 - .5 Manufacture of control panels shall not commence until shop Drawings have been reviewed by the Engineer.
- .8 Enclosures are to be rigidly constructed with angle iron or channel supporting frame, suitably braced, and stiffened to prevent any bowing or deformation during shipping or installation.
- .9 Stainless steel panel enclosures are to be smooth, free of sharp edges and blemishes, and thoroughly de-greased before finishing. All interior and exterior surfaces are to be unpainted, smooth brushed finish.
- .10 The door, back-panel, and main enclosure shall be fitted with welded studs and nuts suitable for attachment of bonding and grounding wires. Ground studs shall not be painted.
- .11 All doors and edges are to be neatly turned in and be smooth finished. No visible welding seams will be accepted.
- .12 Unless otherwise indicated, doors are to be flush fitting with gasket, hung on concealed or piano type hinges and provided with a 3-point latch and locking type handle.
- .13 Enclosures are to be fitted with an interior, removable 2.7 mm thick steel equipment mounting backplane. Fastening of equipment assemblies to the panel backplanes is to be by means of appropriately sized drilled and tapped screw holes. Machine screws with lock washers are to be used; self-tapping hardware is not acceptable.
- .14 A metal document pocket is to be mounted within the enclosure; minimum 300 mm wide.
- .15 Enclosures are to be completely dead front type with flush panel mounted equipment having back connection terminals. Colours of instrument bezels and switch escutcheon plates are to be approved by the Engineer.

- .16 Cut-outs for panel-mounted equipment are to be neatly cut, properly aligned, and sized so that the hole is completely covered by the front bezel. Equipment and instrument cases are to be preferably held in place by rear connected fittings. Any front-fixing required is to be only by means of chrome-plated machine screws.
- .17 Equipment is to be mounted to ensure adequate clearance between door mounted and backplane mounted components with the panel door closed. Relay base and terminal block rails are to be located square to the backplane. Door mounted instruments are to align horizontally and vertically on edges or centre-lines as generally indicated. All internally mounted equipment is to be arranged for ease of access and removal when necessary. No equipment is to be mounted on panel sides.
- .18 Group components symmetrically on panel face and backplanes into logical groups.
- .19 All panel and internally mounted equipment are to be complete with an engraved legend on black Lamicaid nameplate having white letters no smaller than 6 mm. The panel is to have an engraved identification nameplate having letters no smaller than 12 mm. All details of engraved inscriptions are to be approved by Engineer.
- .20 Wiring, terminals, and equipment shall be clearly marked. Label circuit breakers and provide a legend attached to the back of the panel door. Label relays. Terminal block numbers shall follow a clear and consistent pattern. Wire markers shall be machine printed on heat shrink bands. Wires shall be labelled at each end with the termination information that it connects to, so if a wire is temporarily removed, it can be reinstalled without referring to wiring diagrams. All I/O modules shall be fully wired to terminal blocks, including spare I/O points.
- .21 Each control panel shall be neatly arranged using plastic wiring duct for routing of internal wiring, and for field wiring to be terminated. Size ducting for maximum final fill of 75%. Wiring harnesses for connection to door-mounted equipment shall be protected with nylon or polyethylene spiral wrap. Provide sufficient cable slack so that cables are not stressed. Protect wiring from any sharp edges using grommets. Fasten wire harnesses using nylon tie-wraps.
- .22 Panels are to be equipped with internal LED lamp and shall be controlled with panel door switch.
- .23 The PLC control panel shall be equipped with a separate breaker for a normal power 120 V AC duplex outlet suitable for plugging in a laptop. Receptacle to be DIN rail mounted such as Weidmuller "Compact 12 Amp" model in accordance with W10-03. This is sized to power only small equipment such as laptops.
- .24 Panels are to include a fold-up ledge inside the door big enough to provide a working surface for a laptop with a 17" screen. Ledge should lock in place at the lower position.

2.5 INSTRUMENTATION WIRING

- .1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type with shielding of metallized tapes over each pair and overall covering of PVC jacket and interlocked armour of aluminum strip.
- .2 All panel wiring is to be #14 AWG type TEW, minimum 19-stranded copper for 15 A protected circuits. All other control and terminal interface wiring are to be #16 AWG TEW and protected at 5 A or less.

- .3 Analog circuit wiring to be PVC jacketed mylar foil shielded instrument cable with the following:
 - .1 Individually jacketed and shielded twisted pair conductors; twisted triad for RTD signals.
 - .2 Minimum #18 AWG.
 - .3 PVC insulated.
 - .4 Complete with tinned copper drain wire.
 - .5 Approved Product: ShawFlex shielded 2-conductor or 3-conductor cable.
- .4 Cables shall be FT-4 rated.
- .5 Unless otherwise submitted and approved, conductor insulation will be colour coded as follows:

Circuit Type	Colour
PLC 120 V AC circuits	Blue
Analog signal cables	Black (-ve) and Wht, Clr, or Red (+ve)
Power distribution wiring	Black - hot White - neutral Green - ground
24 V DC circuits	Orange - positive Yellow - negative

- .6 Instrumentation wiring installed underground to be armour covered and watertight with a PVC sheath, suitable for underground installation.
- .7 120 V shall not be run in the same cable or conduit as 24 V or analog signals. Maintain separation and avoid long parallel runs.

2.6 PIPING AND TUBING

- .1 All sampling and sensing piping and tubing from the process connection isolation valve to the instrument or control element is to be as specified in this section.
- .2 Connections to be in accordance with instrument details as specified and/or indicated. Pipe or tube fittings and valves for process leads to instrument and control elements are to be of the type, material and pressure standard as called for on the particular process piping standard of the line pressure being sensed, if not specified elsewhere.
- .3 Process leads are to be sloped, vented, and sized in accordance with accepted instrument practices in the industry. Unions and connection isolation valves are to be provided in the pipe or tubing as required to allow removal of instruments for service.
- .4 Piping and tubing lines between instruments and points of connection are to be supported and located so as to be protected from deflection damage.
- .5 Instrument piping, tubing, and fittings shall be 6 mm diameter 304 stainless steel, Swagelok or approved equal.

2.7 WIRE MARKERS

- .1 Wire identification are to be type-written heat-shrink markers, white in colour with black numbers.

- .2 Each end of wire must be marked with a consistent designator, preferably with both the ISA designation and the Terminal Block number they are attached to.

2.8 CONTROL PANEL GROUNDING

- .1 The single-point grounding method shall be utilized.
- .2 The DIN railing shall be fastened to the backplate of the panel using fasteners that include “star” lock-washers to provide a good ground path.
- .3 Ground connections to painted surfaces shall have the paint under the screw removed to bare metal and an internal star washer shall be used.
- .4 The ground wires for panel-mounted equipment shall be terminated in a copper ground bus, ILSCO D167, or equal. The ground bus shall have 20% spare capacity, unless otherwise approved by the Engineer.
- .5 The door of the panel shall be bonded to the main enclosure using a flexible braid ground strap, ILSCO FX, or equal.
- .6 The ground bus and back-panel shall be bonded to the main enclosure using minimum AWG#6 copper ground wire.
- .7 Each control panel (with the exception of the PLC control panel) is to be bonded to the building ground system, with copper cable, suitably sized for the fault level of the system. For the PLC control panel, run a minimum #6 AWG ground wire from the control panel enclosure ground stud to the ground bus bar in the MCC. The ground bus and backplanes shall be bonded to the main enclosure using copper ground wires of the same size.

2.9 CURRENT LOOP ISOLATORS

- .1 Provide loop isolators as required.
- .2 Current loop isolators with the following:
 - .1 Input Signal: 4-20 mA.
 - .2 Output Signal: 4-20 mA.
 - .3 Input Impedance: 250 ohms maximum.
 - .4 Output Load Capability: 900 ohm.
 - .5 Power Supply: 24 V DC.
 - .6 Accuracy/Linearity: 0.1%/0.1% of span.
 - .7 Mounting: DIN Rail.
 - .8 Approved Product: Weidmuller.

2.10 INDICATOR LIGHTS

- .1 Indicator lights are to be heavy-duty oil-tight type with back-mounted screw terminals suitable for operation as indicated on the Drawings, and as outlined following:
 - .1 Control Panel indicators to be:
 - .1 22 mm or 30.5 mm full face.
 - .2 24 V DC multi-LED lamp with push-to-test function.
 - .3 Lens colour and engraving as indicated.

- .2 Approved Product: Allen-Bradley 800T or approved equal.

2.11 PUSHBUTTONS AND CONTROL SWITCHES

- .1 Pushbuttons and control switches are to be heavy duty, oil-tight type with multi-element stackable contact blocks with side wired screw terminals. Contact arrangements and configurations are to be as indicated on the Drawings.
- .2 Unless indicated otherwise, pushbutton operators are to be momentary contact type, flush head construction, black in colour. Backlit type pushbuttons are to have lens colour and engraving as indicated on the Drawings.
- .3 Rotary operators are to be 2, 3 or 4-position, wing type, maintained or momentary contacts as indicated on the Drawings.
- .4 Illuminated operators are to have clearwing style operator toggles, with internal indicating lamp, lamp voltage as indicated on the Drawings.
- .5 Each device is to be fitted with an operation identification escutcheon plate.
- .6 Pushbuttons and control operators are to be generally provided as follows:
 - .1 Pushbuttons to be sized to match indicators full-face operator type with engraving as indicated on the Drawings.
 - .2 Control Switches to be sized to match indicators 2 or 3-position multipole as required, complete with Type 12 or 13 enclosure, and nameplate escutcheon engraving as indicated on the Drawings or in the instrument lists.
 - .3 Approved Product: Allen-Bradley 800T or approved equal.

2.12 CONTROL RELAYS

- .1 General Purpose relays (heavy-duty) shall be 2PDT, with contacts rated 10 A. Relays shall have LED indications and those with dc coils shall have diode protection:
 - .1 Approved Product: Omron LY2N-D2.
- .2 PLC interface relays shall be 1PDT with contacts rated 6 A, for high continuous current applications contacts are to be rated minimum 10 A:
 - .1 6 A rated relays approved product:
 - .1 Phoenix Contact model PLC-RSC-24DC/21.
 - .2 Weidmuller model TRS 24VDC 1C0.
 - .3 Approved equal.
 - .2 High continuous current relays approved product:
 - .1 Phoenix Contact model PLC-RSC-24DC/21HC.
 - .2 Weidmuller model TRS 24VDC 1C0 16A.
 - .3 Approved equal.

2.13 TERMINAL BLOCKS

- .1 Terminal blocks are to be provided complete with mounting rails or channels for connection to field device wiring. Terminals are to be tubular clamp type, 5 mm, rated at 300 V with the current rating being equal to the maximum current rating of the conductors but not less than 20 A. See Drawings for terminal block model.

- .2 All PLC I/O to be wired through isolating disconnecting terminal blocks. In addition, analog I/O shall have its positive signal wired through a dis-connectable fused terminal block.
- .3 Use grounded terminal blocks for termination of cable shields. These blocks shall be identified with Yellow/Green colour coding.
- .4 All spare conductors are to be terminated on terminals.
- .5 Terminal block identification is to match the conductor identification number where possible.
- .6 Shorting bars are to be used for jumpering adjacent terminal blocks. Wire jumpers are not acceptable.
- .7 Terminals shall be of the following types:

Terminal Type	Manufacturer Reference	Alternative Product
Screw Terminal	Weidmuller WDU 2.5	Phoenix Contact UK 2.5
Fused Terminal	Weidmuller WSI 6LD	Phoenix Contact UK HESI LED
Disconnection Terminal	Weidmuller WTR 2.5	Phoenix Contact MTK
Grounding Terminal	Weidmuller WPE 2.5	Phoenix Contact UK 6 N-PE/N

2.14 SET POINTS AND ADJUSTMENTS

- .1 All instrument and control elements are to be supplied with the range, scale and operating configuration as indicated on the Specification sheets. Field calibrate and adjust all elements to the Specifications as provided by the Engineer during construction.
- .2 Record the final settings and submit with the O&M manuals.

2.15 CONTROL PANEL POWER DISTRIBUTION

- .1 Circuit breakers for sub-circuit power supplies are to be rated as indicated on the Drawings, except where otherwise required by the hardware or field devices for Manufacturer's recommended protection:
 - .1 Approved Product: Circuit breakers shall be ABB type SU201M-K or approved equal.
- .2 Control panel power distribution is to be as indicated on the single line diagrams and schematics on the Drawings.
- .3 DC control power shall be distributed using dis-connectable fused terminal blocks as specified in the following section.

2.16 24 V DC POWER SUPPLIES

- .1 The power supply shall provide regulated 24 V DC power from a nominal 120 V AC source. The power supply will be located within the PLC control panel. It shall have built-in protection for short circuit and overload conditions.
- .2 All power supplies are to have a redundant partner located in the same cabinet wired in a manner to handle the entire load if one power supply fails. There should be no manual or automated process processor required to switch from one power supply to the other.

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- .3 Determine loading of power supply and increase current rating if specified model does not have 50% additional capacity.

- .4 Acceptable Product:

- .1 Weidmuller PROtop series.
- .2 Phoenix Contact QUINT4-PS-1AC/24DC/10 :
 - .1 If using QUINT4 series include a QUINT-ORING/24DC/2X10/1X20 redundancy module to balance the power from the redundant power supplies and signal if a power supply is de-energized.
- .3 Approved equal.

2.17 CONTROLS POWER FILTER

- .1 Power filter shall be series hybrid type with capacity as indicated on drawings at 120 V AC.
- .2 DIN rail mounted.
- .3 Power filter shall have relay contact output for status monitoring.
- .4 Approved Product: Eaton AEGIS series.

2.18 UN-INTERRUPTIBLE POWER SUPPLIES (UPS)

- .1 UPS to be “true online double conversion” type with 120 V AC input and 120 V AC true sine-wave output, with lights indicating active output and load on battery, and with output active switch.
- .2 UPS to be CSA approved.
- .3 Output capacity: Sized for 30-minute operation of the control system. Panel supplier to confirm UPS sizing based on panel power consumption.
- .4 Mounting location: In bottom of control panel.
- .5 Options: relay module for PLC monitoring.
- .6 Manufacturer: Eaton Powerware 9PX or approved equal.

2.19 ETHERNET SWITCH

- .1 Ethernet switches with total minimum 4 RJ45 ports for 10/100 Mbps transmission speed.
- .2 Network segment length: 100 m.
- .3 Auto negotiation and autocross, no configuration of the switch required.
- .4 Power supply shall be 24 V DC.
- .5 cUL or CSA approved.
- .6 Acceptable Product: Allen Bradley Stratix 2500 Series or approved equal.

2.20 PROGRAMMABLE LOGIC CONTROLLER (PLC)

- .1 Processors shall have Ethernet/IP ports for programming and data communication. Provide a non-volatile memory card for back-up of the application program.

- .2 Digital Input modules shall be rated for 24 V DC, with interposing relay where monitoring a voltage signal in the field which is other than 24 V DC.
- .3 Digital Output modules shall be rated for 24 V DC. Provide PLC terminal block relays (specified elsewhere) for isolation to other voltages or for dry contacts.
- .4 Analog modules shall have isolated 4-20 mA inputs and outputs as indicated on the Drawings. Provide signal converters as required.
- .5 32-point modules shall not be used as the wiring is too congested.
- .6 Pre-formed cordset with flying leads may be used, wiring harnesses connecting to terminal blocks shall not be used.
- .7 Provide sufficient I/O of each type for the application, plus capacity for addition of future I/O modules for another 15%.
- .8 The PLC power supply shall be supplied from 24 V DC and shall have capacity for the installed system plus 25% spare future capacity.

2.21 CELLULAR RADIO

- .1 Communication band: LTE.
- .2 Include Phantom Dual Band Antenna (Laird model TRA6927M3), and coax cable such that antenna is mounted on panel.
- .3 RJ45 10/100 Ethernet Port.
- .4 Integrated VPN tunnelling and firewall security.
- .5 Unit shall be compatible with owner preferred cellular network.
- .6 Power supply shall be 24 V DC.
- .7 Coordinate with the owner and engineer to supply any required SIM cards and associated data plans to cover communications for cellular alarm dialer.
- .8 Approved Product: Refer to Drawings.

2.22 PLC INPUT/OUTPUT LIST

- .1 The PLC I/O List is Appendix B to this section.

2.23 PROCESS NARRATIVE

- .1 Process Control Narrative is Appendix A to this section.

Part 3 Execution

3.1 MOUNTING/CONNECTING CONTROLS, INSTRUMENTS AND ACCESSORIES

- .1 Install instruments in accordance with the manufacturer's instructions and in accordance with the Drawings. Mount instruments rigidly supported, level and plumb, and in such a manner as to provide accessibility, protection from damage, isolation from heat, shock and vibration, and freedom from interference with other equipment, piping, and electrical Work.

- .2 Instruments and control panels shall not be installed until construction Work adjacent to instrument has been completed to the extent that there shall be no damage to the instrument installation by such construction Work. Where not practical, provide mechanical protection for the instrument, to the satisfaction of the Engineer.
- .3 Instrument devices including accessories shall be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments shall face toward, in line of sight and within reading distance of the normal operating area.
- .4 Allow sufficient clearance for removal of equipment such as level displacers and floats, rota-meter floats, control valves and plugs.
- .5 Mount field located items of instrumentation on building columns and walls where such building columns or walls are accessible. Provide pipe stands and/or other means of support where mounting on columns or walls is not practical.
- .6 Identify instruments clearly by means of Lamicoid tag.
- .7 Panels, control stations, and other equipment are to be protected against the entrance of dust, dirt, and moisture, and protected against mechanical injury while rough, dirty, wet, or dusty work is in progress. Damage to equipment, including marring of painted surfaces caused by failure to properly protect the equipment, are to be promptly repaired by the Contractor to the satisfaction of the Engineer.

3.2 COORDINATION OF THE WORK

- .1 Other trades will be installing equipment, which may affect the arrangement of tubing, conduits, and equipment. The Contractor to notify other trades of all openings, anchors, hangers, or other provisions for the installation of this Work in ample time so that proper provision can be made. Failure to comply with this requirement on the part of the Contractor will not relieve him of the cost of cutting openings, installing brackets, etc., at a later period and subsequent patching.
- .2 Contractor shall provide support and coordination to subcontractors for PLC I/O testing, communications system testing, start-up, commissioning, and training for the control system.

3.3 POWER, CONTROL, AND INSTRUMENT CABLE INSTALLATION

- .1 No conductor is to be drawn into any raceway, or cables placed on tray until all Work that may cause injury to cable or conductor insulation has been completed. Care is to be exercised in the pulling of conductors. A competent person is to be stationed at the feed end of any pulling operation to properly guide and feed cables and conductors. Conductors are to be trained and guided to prevent twisting, kinking, or looping. Only talc, soap, or other CSA approved lubricants are to be used to assist pulling operations. Grease type lubricants will not be permitted.
- .2 Conductors emerging from individual conduits terminating into the open area below a control panel are to be neatly routed and collected into bundles. Bundles are to be secured with nylon cable ties. Conductors are not to be taped or laced.

- .3 Conductors serving terminal boards are to be neatly dressed into a cable and secured with cable ties. The cable is to be freed with individual conductors looping around the cable and aligning, at right angles to the terminals on the terminal board. Loops are to enable repositioning of any conductor up to four terminals away.
- .4 Use liquid-tight flex conduit for final connection of cable to instruments. Flex conduit is to be a minimum of 300 mm and maximum of 600 mm long.
- .5 Under no circumstances is control wiring to be placed in the same conduit as a power circuit.
- .6 Instrumentation and communication network cables and conduits are to be routed to maintain the maximum possible segregation from power cables.
- .7 At each end of the run sufficient cable is to be left for termination.
- .8 Splices in instrumentation cables are not permitted unless approved by the Engineer.
- .9 Cable shields are to be terminated and grounded to clean instrument ground bus at one end only, namely at the Local Control Panel.

3.4 PAINTING

- .1 Painted surfaces which are damaged in any way, i.e., by welding, scraping, cutting, etc., are to be thoroughly cleaned, primed with a rust-inhibiting primer, and repainted to the original colour. The finished job is to meet or exceed the original painting Specification.

3.5 WELDING

- .1 The Contractor is to fabricate and install all brackets, hangers, etc., necessary to complete this contract. All welding and welding materials is to conform to the requirements of the CSA W-59.

3.6 CLEANUP

- .1 The interior of enclosures and boxes is to be cleaned of dust, dirt, and loose material, and shall be vacuum cleaned. The use of compressed air to remove debris is not acceptable.
- .2 All fastening screw holes provided in boxes and enclosures are to have a fastening screw installed.
- .3 On completion of Work, remove debris from the site, repair any damage and leave the installation in a clean and neat condition to the satisfaction of the Engineer.
- .4 In the event that a final inspection cannot be completed because of an excessive deficiency list or that the plant cannot be placed into operation because of deficient or defective Work, the Contractor will be charged by the Client for the additional engineering services, reinspection, and later start-up assistance.
- .5 Keep all work areas clean of debris, waste, and surplus materials.

3.7 COMPONENT INSTALLATION

- .1 The contractor is responsible for the general arrangement of components to be installed. Equipment is to be mounted to ensure adequate clearance between door mounted and backpan mounted components with the panel door closed. All items are to be clearly identified with an engraved Lamicoid nameplate securely fastened in place.

- .2 All internally mounted equipment is to be arranged for ease of access and removal when necessary. Flexible wiring harnesses with approved terminating connectors at both sides are to be provided for any hinged panel or door mounted equipment and each shall have 20% spare capacity.
- .3 The panel is to be provided with a tapped copper bus bar for panel components and shield grounding, plus 20% spare, unless otherwise approved by the Engineer.
- .4 Relay base and terminal block rails are to be located square to the backpan. Door mounted instruments are to align horizontally and vertically on edges or centrelines as generally indicated.
- .5 Fastening of equipment assemblies to the panel backpans is to be by means of appropriately sized drilled and tapped screw holes. Machine screws only with lock washers are to be used; self-tapping hardware is not acceptable.

3.8 WIRING METHODS

- .1 Identification ferrules are to be placed at each end of all wires. Wire identification system is to be as specified elsewhere.
- .2 All wiring is to be neatly formed, tie-wrapped and frequently supported. A primary requirement will be neatness. No splices will be allowed. All wiring is to be installed continuous from terminal to terminal.
- .3 Each wire termination at a stud is to have a ring-type crimp-on connector. All wiring terminating at tubular screw terminals is to be stripped for full insertion into the terminal. Wiring termination at solder terminals is to be mechanically secure before solder is applied. Resin type solder is to be used.
- .4 Wire looms are to be secure and wire forming shall provide enough length to ensure that there will be no mechanical tension on wire terminations.
- .5 Mechanical checks are to be made to determine if there are any broken parts, wires, mechanical binding, loose screws, and proper soldered connections. Mechanical tolerances are to be checked on all units including contact grip and wires.
- .6 Each panel is to be bonded to the building ground system, with minimum AWG #6 copper wire.
- .7 Current loop isolator terminal blocks are to be used on all analog 4-20 mA loops that exit or enter the building to the PLC.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit in accordance with Division 01 and Division 26.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in Division 01 and Division 26.
- .2 Record instrument configuration parameters and include in manuals.
- .3 Keep all manuals shipped with instrument. Turn over to owner with O&M Manual submission.

1.3 OPERATING ENVIRONMENT

- .1 Supply and install all accessories such as intrinsic safety barriers as required for instruments to be installed in operating environments listed below.

Part 2 Products

2.1 GENERAL

- .1 All instruments to be installed in Zone 1 and Zone 2 hazardous environments shall be either rated for the hazardous environment or supplied with intrinsically safe barriers to achieve hazardous area classification.
- .2 All instruments shall be configurable from local display pushbuttons. Instruments that require a Hart modem to configure are not acceptable.

2.2 VIBRONIC POINT LEVEL SWITCH

- .1 Type: capacitance point level switch with fully insulated rod probe.
- .2 Operation: 24 V DC.
- .3 Probe length: as required. Minimum length 100mm.
- .4 Cable: as required for field wiring to control system.
- .5 Approved Product:
 - .1 VEGA Swing Series
 - .2 E&H Liquiphant series; or
 - .3 Approved equal.

2.3 SUBMERSIBLE PRESSURE (LEVEL) TRANSMITTERS

- .1 Process: raw water hydrostatic pressure.
- .2 Housing: titanium.
- .3 Signal: 4-20 mA.
- .4 Accuracy: 0.1% of full scale.
- .5 Compensated temperature range: -2 to +30°C.
- .6 Power supply: 24 V DC loop powered.
- .7 Factory cable: polyurethane molded, vented with Kevlar. Order factory cable of sufficient length for termination.
- .8 Ambient temperature: 0°C to 40°C.
- .9 Range: according to process requirements. Select range so that 4-20 mA signal is approximately at mid-scale for normal operating.
- .10 Approval: CSA or cUL or cFM.
- .11 Approved Manufacturers:
 - .1 PMC Versaline VL3000 Series with MP11;
 - .2 E+H Waterpilot FMX21; or
 - .3 Approved equal.

2.4 AIR TEMPERATURE TRANSMITTER

- .1 Type: wall-mount temperature transmitter with suitable 100-ohm platinum RTD three-wire sensor.
- .2 Output: 4-20 mA.
- .3 Power: 24 V DC loop powered.
- .4 Provide NEMA 4X enclosure.
- .5 Approved product:
 - .1 Dwyer model BTT-R25-1.

Part 3 Execution

3.1 INSTALLATION

- .1 Assemble and/or install all equipment in strict accordance with Manufacturers and Supplier's instruction.

- .2 Supply and install all instruments as shown on the Drawings.
- .3 Provide proper fastenings and supports.
- .4 Any damage resulting from either failure to observe the installation instructions or as a result of proceeding with the work without complete knowledge of how it is to be done will be the Contractor's responsibility. Make equipment installation and connections by a qualified journeyman to the best standard:
 - .1 Carry out work to produce a neat, accurate, secure, functional installation.
- .5 Repair at own expense, any damage done to the installation or materials while carrying out the work.
- .6 Do not run 120 V AC power and 4-20 mA control signals in the same conduit. Install a ground wire in the conduit and bond instrument to ground. Connect shield drain wire to ground at one end only (in the control panel).
- .7 Scale analog outputs from instruments according to the Engineer's requirements.

3.2 SYSTEM DEMONSTRATIONS

- .1 Provide for field training and instructions as specified in Division 01. The training sessions are to take place prior to commencing the 2-day commissioning test.

3.3 CALIBRATION

- .1 Calibration shall be by an agency specializing in instrument calibration and familiar with wastewater pumping stations and all instrumentation used on-site.
- .2 The calibration agency shall provide and complete comprehensive calibration report forms indicating full instrument make and model numbers, instrument configurations and settings, and instruments performance during calibration.
- .3 Calibrate instruments individually.
- .4 Carry out manual tests to check instrument readings versus measurements made by other means (e.g., perform draw down and refill tests using tape measure and stopwatch). Compare level results of level instrument against levels measured from tape measure. Compare volume results of flow instrument against volumes calculated by flow estimates from draw down and refill tests. Compare volume flow rate results of flow instrument against volume flow rate results calculated from draw down and refill tests. Carry out such testing for as many instruments as practicable. Cross compare the various results to confirm agreement and mass balance to the extent possible.
- .5 For each variable ensure that it is consistent everywhere it is indicated throughout the system (e.g., compare flow meter local display against PLC value of flow, HMI value of flow, trend screen values of flow, and SCADA value of flow). Ensure units and scaling are in agreement and consistent.

- .6 Coordinate units for engineering measurements with operators. Preference shall be SI metric in the most commonly used units (mm, m³, L, s, kPa) except where operators request otherwise.
- .7 Instrumentation shall provide consistent, accurate, repeatable results to stated tolerances prior to being accepted. Calibration agent shall record successful performance for each instrument, on calibration forms.

3.4 WARRANTY

- .1 A written supplier's warranty shall be provided for the equipment specified in this section. The warranty shall be for a minimum period of 1-year from the date of substantial completion. Such warranty shall cover all defects or failures of materials or workmanship which occur as the result of normal operation and service.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Work under this section includes but is not necessarily limited to the categories of the work itemized below for the Raw Water Pump House (RWPH):
 - .1 Demolition of electrical equipment as indicated on Drawings.
 - .2 Supply, installation and commissioning of:
 - .1 Wall-mounted motor starters, including field power and control wiring.
 - .2 Building lighting.
 - .3 Panelboard breakers and all associated circuit wiring.
 - .4 Control panels, relays, switches, indicator lights, power, and control wiring for all HVAC equipment in accordance with Drawings.
- .2 The Electrical contractor is responsible for the supply, installation and testing of all field installed cabling and connections shown at RWPH by:
 - .1 Process mechanical P&ID drawings.
 - .2 Instrumentation communications schematic drawings, Control Panel power distribution single line diagrams and associated details.
 - .3 Panelboard schedules and associated detailed drawings, HVAC equipment schematics.

1.2 CODES AND STANDARDS

- .1 Carry out all work in accordance with these drawings and specifications, meet the latest regulations of Canadian Electrical Code and latest applicable Municipal and Provincial Codes and Regulations. In each and every instance of application, the Code, regulations, statutes, bylaws, or these Contract Documents having most stringent requirement applies.

1.3 PERMITS, FEES, AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Engineer will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .3 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.
- .4 The contractor shall be responsible for coordination and making all arrangements with the utilities for installation/relocation.
- .5 The Electrical Contractor will obtain and pay for all permits required by laws and regulations.

- .6 After completion of the work, the electrical Contractor will certify to the Owner that the inspection authority having jurisdiction has inspected all work. Provide copies of electrical inspection reports to the Engineer.

1.4 SHOP DRAWINGS

- .1 Submit to the Engineer copies of each shop drawing for review. Make sufficient copies of the reviewed set according to Division 01.
- .2 Show on shop drawings, details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line, and schematic diagrams.
- .4 Wiring drawings showing interconnection with work of other divisions are required.

1.5 OPERATION AND MAINTENANCE DATA

- .1 Include information as follows:
 - .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements to permit effective startup, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature will not be acceptable.
 - .3 Provide wiring and schematic diagrams and performance curves.
 - .4 Provide "As-Built" list of parameter settings for all configurable equipment.
 - .5 Include names and addresses of local suppliers for all items included in maintenance manuals.
 - .6 Include a copy of the electrical inspections permit.
 - .7 Include certificate of guarantee.
 - .8 Material to be English.

1.6 OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Provide an instructional training session for the owner's operations staff. The session shall commence shortly after project take over. The purpose of the training session shall be to instruct the operations staff on operating and maintenance procedures for equipment installed on this project. The training program shall include but shall not be necessarily limited to the following:
 - .1 Instrumentation equipment configuration and maintenance.
 - .2 Control panels.

1.7 DELIVERY AND STORAGE

- .1 Assume complete responsibility for maintaining all materials and equipment delivered to the site in new condition. Repair or replace damaged articles to the satisfaction of the Engineer. Make arrangements as necessary for proper storage and security of materials delivered to the site.

1.8 PROJECT RECORD DOCUMENTS

- .1 Indicate on record drawings, location of all buried services.
- .2 Indicate accurately significant deviations from contract documents caused by site conditions and changes ordered by Engineer.

1.9 QUALIFICATIONS

- .1 Retain a qualified journeyman electrician with experience on related projects to continuously direct and monitor electrical work.
- .2 Attend site meetings.

1.10 DEFECTIVE MATERIALS AND WORKMANSHIP

- .1 After the work is complete but before final payment, the contractor shall give to the owner a written guarantee that all materials and workmanship are in strict accordance with the plans and specifications and for a period of 1-year, from date of final acceptance at no charge to the owners, replace or repair any defects in material and workmanship not due, in the opinion of the Engineer, to misuse and neglect. This guarantee does not cancel or prejudice other longer guarantees.

Part 2 Products

2.1 GENERAL

- .1 Equipment and material to be new, CSA certified, manufactured to standard quoted, and incorporating additional specified requirements.

2.2 FINISH

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Paint all indoor switchgear and distribution enclosures light grey.
- .3 Clean and touch up surfaces of shop painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean, prime and paint exposed hangers, racks, fastenings, etc. to prevent rusting.

2.3 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment. Hand-painted identification will not be accepted.
- .2 Use phenolic plastic laminate, machine engraved black plate with white letters. Nameplates shall be mechanically attached; self-adhesive types are not acceptable.

Nameplate Sizes (metric)

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	19 x 90 mm	1 line	8 mm high letters
Size 5	19 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	13 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .3 All identification to be English.
- .4 Nameplates for terminal cabinets to indicate system and/or voltage characteristics.

2.4 WIRING IDENTIFICATION

- .1 Provide permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Make uniform phase-to-main lug connection on all equipment (i.e., panelboard, starter, terminal blocks, disconnect switches).
- .2 Maintain identification system at all junction boxes, splitters, cabinets, and outlet boxes.
- .3 Phase wiring to be red, black, and blue. Neutral conductor to be white. Building ground to be green. Isolated ground to be green with orange tracer.

2.5 CABLE IDENTIFICATION

- .1 Provide lamacoid cable tags for all cables. Tags shall be zip-tied to cables using heavy-duty zip-ties.
- .2 Cable tags shall be installed at each end of cable.
- .3 Cable tags shall include source and destination equipment designations.
- .4 Maintain identification system at all junction boxes, splitters, cabinets, and outlet boxes.

2.6 CONDUIT IDENTIFICATION

- .1 Label pull boxes and other material components of a system providing information as to name and function. Use Size 2 label. Where concealed, identify all junction boxes with black felt marker indicating circuits and/or system; add a second label to the wall or ceiling surface adjacent.

2.7 WIRING TERMINATIONS

- .1 Lugs, terminals, and screw connectors used for termination of wiring must be suitable for conductor material used. Copper unless indicated otherwise.

2.8 MANUFACTURER'S AND CSA LABELS

- .1 Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

Part 3 Execution

3.1 LOCATION OF OUTLETS

- .1 Coordinate the rough-in location of all outlets with general arrangement, structural and mechanical drawings. Ensure compatibility with finishes, accessories, and devices by others.
- .2 Coordinate the rough in for motors with other contractors to ensure compatibility.
- .3 Location of outlets indicated may be changed by the Engineer at no extra cost or credit, providing distance does not exceed 3 m and information is given before installation and construction commence.
- .4 Make necessary adjustments when interior finish is completed.

3.2 MOUNTING HEIGHTS

- .1 Mounting heights of equipment are from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated, verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise:
 - .1 Local switches: 1350 mm
 - .2 Wall receptacles:
 - .1 General process areas: 1200 mm
 - .2 Finished areas (office): 400 mm
 - .3 Above top of continuous baseboard heater: 200 mm
 - .4 Above top of counters or back splash: 175 mm
 - .5 Chemical pump outlets: 1500 mm
 - .6 Reservoir hatches: 400 mm
 - .3 Panelboards (to top of panel): 1800 mm

3.3 CONDUIT, SLEEVES AND HOLES

- .1 Holes through exterior walls and roof to be flashed and made weatherproof.
- .2 Make necessary arrangements for cutting of chases, drilling of holes and other structural work required to install electrical conduits, cables, pull boxes and outlet boxes.

- .3 Coordinate with general contractor to insert sleeves where wiring passes through concrete walls and floors.
- .4 Install cables, conduits and fittings neatly and closely to building structure.

3.4 INSULATION RESISTANCE TESTING

- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
- .2 Megger. circuits, feeders and equipment up to 600 V with a 1000 V instrument.
- .3 In all cases, ensure that resistance to ground is not less than required by code prior to energizing.

3.5 CUTTING AND REPAIRING

- .1 Include all cutting for installation of material and equipment. Retain the services of appropriate tradesmen on this project. Provide supervision and direction and be fully responsible. Do not cut beams or other structural members without the written permission of the Engineer.
- .2 Coordinate patching and painting of surfaces in areas to be finished by other trades. In areas where no finish is to be applied, assume responsibility for patching and painting of surfaces. Engage qualified tradesmen for all patching and painting. Patching and painting to be in accordance with the specifications governing this work to the satisfaction of the Engineer.

3.6 PAINTING

- .1 Paint all iron or steel structures fabricated and installed for supporting equipment after wire brushing clean and applying one prime coat of paint. After all equipment is installed and all piping complete provide a touch-up coat of enamel to matching the equipment being supported.
- .2 Do not paint surface-mounted PVC conduit and boxes in process areas.

3.7 DRAWINGS AND SPECIFICATIONS

- .1 The drawings and specifications are intended to supplement each other, and any detail mentioned on 1 and omitted on the other shall be treated as if included on both.
- .2 The drawings do not show all construction details and any information involving accurate measurements of the building shall be taken from the building drawings or at the buildings.

3.8 EXCAVATION AND BACKFILL

- .1 Ensure that route and depth of excavation for underground electrical service is as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work. Pay all associated costs.

- .2 Machine tamp backfill in 150 mm layers to prevent future settling. Level all excess fill and leave the premises in a clean state. Return and correct any abnormal settling which appears later by adding additional fill material and properly backfilling to a uniform level.
- .3 Where cable or wire runs through concrete walls encase in rigid conduit.
- .4 Check in advance the location of all underground power, water, gas or other services which may exist and excavate with care when in the proximity of the services. Be responsible for all damage caused during excavation and backfilling.

3.9 BREAKDOWN AND PRICES

- .1 After award of contract and at the request of the Engineer, prepare a breakdown of the contract into major divisions as outlined by the Engineer showing the contract value of each division.
- .2 During the course of construction when requested, submit a price for the performance of additional work, broken down as prescribed by the Engineer, to show the quantity and price of the items of material required to carry out the work together with a separate listing of the labour charges for each item.

3.10 EXISTING CONDITIONS

- .1 Before submitting a tender examine the site and the local conditions affecting the work under this division and verify that the work can be satisfactorily carried out as shown on the plans without changes to the building. Examine also the mechanical drawings and specifications. Should the examination show the requirements for additional work beyond the scope of the drawings and specifications, advise the engineer at least 7-days before tenders close. Failure to do so implies acceptance of existing conditions and that all allowances as may be necessary to complete the work are included in the tender.

3.11 CLEANING

- .1 Clean construction materials from wiring devices, cover plates, outlets, cabinets, enclosures, tubs, etc.
- .2 At time of final cleaning, clean all lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

3.12 INSPECTION

- .1 Take immediate and direct action to respond to items on deficiency lists during the construction period and on completion of project.

3.13 COMMISSIONING

- .1 Make all arrangements to include full participation of Manufacturer's technical representatives. Where deemed necessary by the Engineer, arrange for personnel from the factory to contribute to the commissioning process without cost to the Owner.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Manufacturer shall ensure product meets standards in accordance with Division 01.

Part 2 Products

2.1 INSTRUMENTATION WIRING

- .1 Refer to Section 25 10 00 - Integrated Automation Network Equipment.

2.2 BUILDING WIRES

- .1 All power and control cabling shall be adequately supported armoured Teck cable or non-armoured cable run in conduit. A combination of Teck and conduit will also be acceptable.
- .2 Teck connectors shall be Thomas & Betts StarTeck ST in ordinary locations and StarTeck XP in hazardous locations.
- .3 Conductors to be concentric stranded soft annealed copper, covered with X-link insulation, type RW90.
- .4 Cable to be complete with inner black PVC jacket, aluminum alloy interlocked armour and outer jacket of PVC. Cables shall be rated for -40°C to 90°C.
- .5 Minimum bending radius to be minimum seven times the overall cable diameter, as prescribed by the CEC, or as recommended by cable Manufacturer.
- .6 Conductors shall be stranded for #10 AWG and larger.
- .7 Cables shall be sized per the CEC or as indicated in drawings, minimum size shall be #12 AWG.
- .8 Insulation rating shall be 1000 V for 600 V circuits, and 600 V for circuits 240 V and less.
- .9 Cable for Class 2 Extra Low Voltage controls (thermostats) shall be type LVT installed in conduit.
- .10 Provide "live" spring type terminators, Marrette or approved equal.

2.3 COMMUNICATION CABLE

- .1 Cat-6 Local Area Network Cable to be used for both data and telephone lines.
- .2 Communication cables shall be run in PVC conduit.

Part 3 Execution

3.1 INSTALLATION

- .1 The intent is that cables shall be Teck90 run on tray or adequately surface mounted. Conduit may be used for cables that are not specified as armoured type and for transitions to junction boxes, through wall penetrations or in-slab conduit as indicated.
- .2 Cable is to be neatly installed parallel to building lines on channel supports or in cable tray. Single runs may be supported with cable clamps. Install cables to allow maximum free space for future cables. Haphazard installation of cable will not be accepted.
- .3 Cable and conduit shall not be installed on walking surfaces or floors.
- .4 Draw conductors into conduit in 30 m sections or three 90° bends. Provide pull boxes to meet this requirement.
- .5 Lubricant for pulling conductors to be wax base insoluble in water and non-hardening. Lubricants to be approved for the type of conductor insulation.
- .6 No conductor is to be drawn into any raceway, or cables placed on tray until all work that may cause injury to cable or conductor insulation has been completed. Care is to be exercised in the pulling of conductors. A competent person is to be stationed at the feed end of any pulling operation to properly guide and feed cables and conductors. Conductors are to be trained and guided to prevent twisting, kinking, or looping.
- .7 Conductors emerging from conduits and tray prior to entering power and control equipment panels are to be neatly routed and grouped. Bundles are to be secured with nylon cable ties. Conductors are not to be taped or laced.
- .8 Use liquid-tight flex conduit and Teck connectors for final connection of cable to equipment as appropriate. Flex conduit is to be a minimum of 300 mm and maximum of 600 mm long.
- .9 Under no circumstances is control wiring to be placed in the same conduit as a power circuit.
- .10 Instrumentation and communication network cables and conduits are to be routed to maintain the maximum possible segregation from power cables.
- .11 At each end of the run enough cable is to be left for termination.
- .12 Splices in cables are not permitted unless approved by the Engineer.
- .13 Instrument cable shields are to be terminated and grounded to clean instrument ground bus at one end only, namely at the control panel.
- .14 Provide permanent identification tag on all cables in accordance with general electrical requirements.

- .15 Fire-stop all cables running through fire rated walls such as electrical and generator rooms.

END OF SECTION

Part 1 General

- .1 Not applicable.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 40 mm x 40 mm x 3 mm, surface mounted or suspended. Finish shall be hot-dipped galvanized. Thomas and Betts Superstrut or approved equal.
- .2 Support channels and components in Category 1 and Category 2 locations shall be stainless steel.
- .3 Provide manufactured accessories for channel supports such as:
 - .1 Spring loaded retainer nuts.
 - .2 Brackets.
 - .3 Conduit clamp.

2.2 CONDUIT AND CABLE CLAMPS

- .1 Use T&B “Cobra” clamps for fastening conduit and cable to support channels, sized as required.
- .2 Material shall be electro-galvanized steel.
- .3 Material in Category 1 and Category 2 locations shall be stainless steel.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .3 Fasten exposed conduit or cables to building construction or support system using straps:
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .4 Suspended support systems:
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

- .2 Support two or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .5 Runs of cable shall be supported at minimum 600 mm intervals.
- .6 Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support conduit and cable runs.
- .7 Ensure adequate support for raceways and cables dropped vertically to equipment including motor terminal box where there is no wall support.
- .8 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .9 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .10 Install fastenings and supports as required for each type of equipment cables and conduits in accordance with manufacturer's installation recommendations.
- .11 Touch up cuts to galvanized strut or rods with zinc-rich paint (minimum 65% zinc content) having inorganic binders, in accordance with ASTM A780.

END OF SECTION

Part 1 General

- .1 Not used.

Part 2 Products

2.1 CAST BOXES

- .1 FD boxes to be cast aluminum with female threaded hubs suitable for surface mounting as shown and required.

2.2 PVC BOXES

- .1 PVC boxes of same space requirement as type FD cast boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Use cast boxes unless otherwise indicated and in conjunction with Teck cables.
- .2 Support boxes independently of connecting conduits.
- .3 In concrete block construction, set 100 mm square sheet metal boxes into the masonry block core and provide a square cut extension cover to the face of the block.
- .4 Install 100 mm square sheet metal boxes with single-gang plaster ring in steel stud wall construction and moveable partitions. Use caddy metal stud support clips.
- .5 Outlet boxes flush-mounted in finished surfaces to be provided with a blank plate as specified elsewhere.
- .6 Install F.S. cast outlet boxes for devices located outdoors. Also use in watertight areas that need more mechanical protection than PVC boxes provide.
- .7 Fill boxes with paper to prevent entry of construction material.
- .8 Set floor boxes in concrete floor recess as detailed. Securely fasten in place. Chip existing concrete as required.
- .9 Use PVC boxes in potentially wet locations.
- .10 Any conduits penetrating through main plant floor or through wall shall use sealing fittings to prevent flow of water in the event of flooding or rain. Care shall be taken to prevent water ingress into junction boxes, panels and equipment in a flood condition.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Manufacturer shall ensure product meets standards in accordance with Division 01.

Part 2 Products

2.1 CONDUITS

- .1 Rigid PVC conduit, solvent welded, shall be used unless otherwise noted.
- .2 Rigid PVC conduit shall not be used in Category 1 or Category 2 hazardous locations.
- .3 PVC fittings and boxes to match the conduit system being used.
- .4 Liquid-tight flexible metal conduit shall be used for final connection to equipment unless Teck cable is used.
- .5 Non-metallic flexible conduit is only allowed for running LVT cable to thermostats.
- .6 Pull an adequately sized insulated ground conductor in all conduits.
- .7 All conduits shall be supported independently of junction boxes, fittings, devices, etc.

2.2 PVC OUTLET BOXES

- .1 PVC single and multi gang flush device boxes for flush installation minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side.
- .2 PVC utility boxes for outlets connected to surface-mounted PVC conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CAST ALUMINUM OUTLET BOXES

- .1 Use cast type FS or FD boxes for exterior switch or receptacle outlets, surface mounted.

Part 3 Execution

3.1 INSTALLATION

- .1 All wiring shall be run either in conduit or adequately supported Teck/armoured power and instrumentation cabling, unless otherwise indicated.
- .2 Install PVC conduit where it is not subject to mechanical damage. Use of PVC conduit in hazardous locations, or in insulated walls or ceilings is not acceptable.

- .3 Coordinate layout fully to provide a uniform installation parallel to building lines. Avoid excessive offsets and crossovers. Group conduits on electrical channel where there are three or more parallel runs. Do not install PVC conduit adjacent to high temperature equipment.
- .4 Do not run conduit on the walking surfaces of floors.
- .5 Install conduit so that it can drain and have no pockets in which water can be collected.
- .6 Fire-stop all conduits passing through fire rated walls such as electrical and generator rooms.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Bends are to be parallel radius.
- .3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .4 Do not pass conduits through structural members unless indicated otherwise.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Manufacturer shall ensure product meets standards in accordance with Division 01.

Part 2 Products

2.1 SWITCHES

- .1 Switches shall be of one Manufacturer throughout project.
- .2 Approved product:
 - .1 Arrow Hart 1891 series;
 - .2 Hubbell 1201 series; or
 - .3 Leviton 1201 series.

2.2 COVER PLATES

- .1 Cover plates for wiring devices with the following:
 - .1 Cover plates to match switch and receptacles.
 - .2 PVC covers for wiring devices installed in surface-mounted PVC boxes.
 - .3 Stainless steel cover plates for flush-mounted boxes.
 - .4 Wet location cover plates, complete with gaskets and "while-in-use" covers for duplex receptacles located exterior.
 - .1 Hubbell WP8M or equal.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .2 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 This section covers work related to Division 26 for provision of motor starters to 600 V.

1.2 SUBMITTALS

- .1 Submit product data in accordance with Division 01.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Schematic diagram for each type of starter.
 - .6 Wiring diagram for each type of starter.
 - .7 Component Manufacturer, models and types.

1.3 OPERATION & MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in Division 01.

Part 2 Products

2.1 GENERAL

- .1 All starters and drives shall be CSA approved.

2.2 FULL VOLTAGE MAGNETIC STARTERS

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type. Contactors shall be NEMA rated. IEC rated starters are not acceptable.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Wiring and schematic diagram inside starter enclosure in visible location.
 - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include magnetic circuit breaker with operating lever on outside of enclosure to control circuit breaker and provision for:
 - .1 Locking in "OFF" position with up to three padlocks.
 - .2 Independent locking of enclosure door.

- .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
 - .1 Pushbuttons, Selector switches: heavy duty labelled as indicated.
 - .2 Indicating lights: heavy duty type with Push-to-Test, LED lamps, colour as indicated.
 - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
- .4 Enclosure:
 - .1 Rating: NEMA 3R.
 - .2 Paint: ANSI 61 Grey.

2.3 LOCAL DISCONNECT SWITCHES (600 V AND 120/208 V CIRCUITS)

- .1 Single, 2 and 3 pole non-fused disconnect switches with solid neutral located as indicated.
- .2 600 V, 240 V and 120 V rated as required.
- .3 In process areas, NEMA 4X enclosure. Hubbell 13X33D or approved equal.
- .4 For 1-phase HVAC equipment use motor rated 1-P or 2-P switch in PVC box and IPEX VSC15/10 cover.
- .5 Provide capability for lock-out/tagout.

Part 3 Execution

3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct setting of motor protection devices.
- .3 Provide record of as-built settings and include in O&M manual submission.

3.2 TRAINING

- .1 The Manufacturer's field service personnel shall provide training to the Owner's maintenance personnel concerning the operation, configuration, troubleshooting and repair of the FVNR starters.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences and testing at various speeds and in all possible operating scenarios.

- .4 Check that sequence controls, operate as required.
- .5 Operate all equipment both mechanically and electrically to ensure proper performance.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This section covers work related to Division 26 for provision of lighting.

1.2 GENERAL REQUIREMENTS

- .1 Furnish lighting fixtures which are complete in all respects including prewired lamps and LED drivers.
- .2 Submit shop drawings in accordance with Electrical General Provisions.

Part 2 PRODUCTS

2.1 LIGHT FIXTURES - GENERAL

- .1 Supply fixtures according to Luminaire Schedule on the electrical drawings or to be supplied by an acceptable equal supplier. Verification of the equal fixture shall be done during the shop drawing review stage that the fixture is rated for the space (exterior, moisture, corrosion, hazardous rating, etc.) and is a similar type of fixture and lens with equal or better lumen output and lumens per watt rating.
- .2 Provide lamps for each fixture as indicated.

Part 3 EXECUTION

3.1 INSTALLATION

- .1 Check mounting surface construction and fixture compatibility prior to ordering and rough-in.
- .2 Install lighting fixtures level and in straight lines along with building lines. Locate as required to avoid interference with other equipment. Provide adequate separation from sources of heat.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

- .1 Excavation and backfill to conform to the following codes and standards:
 - .1 Local Codes and Bylaws.
 - .2 Occupational Health and Safety Act and Regulations.
 - .3 NBC (latest edition).
 - .4 Saskatchewan Environment.
 - .5 Environment Canada.
 - .6 CSA.
 - .7 ASTM.

1.2 SHORING, BRACING AND UNDERPINNING

- .1 Comply with Saskatchewan Occupational Health and Safety Requirements and applicable local regulations to protect existing features.
- .2 Engage services of qualified Professional Engineer, registered in the Province of Saskatchewan to design and inspect any shoring and bracing required to construct the Work.
- .3 At least 2-weeks prior to commencing Work, submit design and supporting data.
- .4 Design and supporting data submitted to bear the stamp and signature of qualified Professional Engineer registered in the province of Saskatchewan.
- .5 Professional Engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where engineer is employee of contractor, in which case contractor shall submit proof that work by Professional Engineer is included in contractor's insurance coverage.

1.3 EXAMINATION

- .1 Examine the site to ascertain any special conditions and become familiar with any objects which may affect the Work of this section. No extra payment will be made for work resulting from failure to know existing conditions. Examine all drawings for Work that might affect excavation and backfill.

1.4 MONITORING

- .1 Monitor all aspects of the work under this contract to ensure that no damage results to the facilities. Similarly ensure that the operation of the existing adjacent facility is not affected by Work under this contract.
- .2 Monitor all existing above-grade and underground facilities and utilities; protect as required.
- .3 The Owner/Engineer may carry out an independent monitoring program. This program shall not relieve the Contractor of his duties and responsibilities in any way.

1.5 RECORD DRAWINGS

- .1 Provide a surveying assistant to obtain site information for the work included in this section. Submit record drawings in accordance with Division 01.
- .2 Information will be referenced to the completed structure and will generally include:
 - .1 Plan dimensions of the top of the excavation referenced to the perimeter foundation.

Part 2 Products

2.1 MATERIALS

- .1 Topsoil:
 - .1 Topsoil is humus, peat and any organic materials making up the top layer of soil.
- .2 In-situ fill, type 1 fill:
 - .1 Excavated native soil, free from roots, rocks larger than 75 mm and building debris. Excavated material to be approved by the Engineer before use as fill. Do not use silt or highly plastic clay materials to backfill. Backfill with imported granular fill.

- .3 Granular fill, type 4 fill:

- .1 Granular fill, where specified, shall be graded within the following limits:

Sieve Designation	Percent by Weight Passing
18.0 mm	100
12.5 mm	75 to 100
5.0 mm	70 to 75
2.0 mm	32 to 52
0.900 mm	20 to 35
0.400 mm	15 to 25
0.160 mm	8 to 15
0.071 mm	6 to 11

- .4
- .5 Unshrinkable fill: a mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated:
 - .1 Maximum aggregate size to be 6 mm sand.
 - .2 Strength at 28-days: 0.5 ± 0.25 MPa.
 - .3 Slump: 175 ± 25 mm.
- .6 Rock excavation: excavation of massive ledge rock, boulders, bedrock, concrete or masonry, which cannot be removed by a track excavator with a minimum operating weight of 36 t and a minimum bucket capacity of 1.2 m³ without drilling and blasting.

- .7 Boulders: all forms of rock, detached masses of rock, boulders, concrete or masonry, greater than 600 mm in average diameter, that can be removed by a track excavator with a minimum operating weight of 36 t and a minimum bucket capacity of 1.2 m³ without drilling or blasting.

Part 3 Execution

3.1 INSPECTION AND TESTING

- .1 Materials and workmanship to be subject to inspection at any time. Provide access to all places where work is being undertaken or materials are stockpiled.
- .2 The Contractor shall retain an independent testing laboratory to test compaction, as approved by the Owner. All costs for density testing to be paid for by the Contractor.
- .3 The following testing will be undertaken by the Contractor:
 - .1 Density:
 - .1 Conduct tests on compacted fill to ASTM D698-07 for Standard Proctor Density.
 - .2 Frequency of tests:
 - .1 Raw water pump house backfill:
 - .1 Three tests for each depth, increments of 0.3 m.
- .4 The testing agency to report immediately to the Engineer when any procedure is contrary to the specifications or good practice.
- .5 Issue copies of each test result to the Engineer and Contractor's representative within 24-hours of each test.
- .6 Source testing of backfill materials and related costs for conformance to specifications shall be the responsibility of the Contractor. Obtain written approval from the Engineer before hauling fill material to the site.

3.2 FAILURE TO MEET COMPACTION REQUIREMENTS

- .1 If tests reveal improper compaction in filling, remove the defective area and re-compact at the Contractor's expense. The cost of field density tests required to substantiate the results of such re-compaction shall be paid for by the Contractor.

3.3 UTILITY LINES AND STRUCTURES

- .1 Before commencing work, establish the location and extent of all utility lines and structures, in the area of excavation, and notify the Engineer of findings prior to excavation.
- .2 Make good any damage to existing utility lines and structures resulting from work.

3.4 LOCATION AND GRADE

- .1 Erect and maintain sturdy batter boards at each corner of the structure to preserve alignment and grade.

- .2 Re-establish grade in areas of erosion and washout. Shape and slope the restored surface to provide positive drainage away from the structure.

3.5 CONSTRUCTION METHODS

- .1 Make computations of the amount and nature of excavation and backfill required.
- .2 Select methods of excavation, dewatering, sheet piling and construction suitable for actual conditions encountered in the work. The Contractor is solely responsible for the safety and adequacy of the methods employed.
- .3 The contractor is responsible for groundwater conditions and dewatering to keep the site dry during the duration of construction.
- .4 Prior to construction submit to the Engineer an outline showing intended methods for excavation and backfill of the structure and dewatering in order that the Engineer may judge the general adequacy of the proposed methods.
- .5 Coordinate all work of this section with installation of exterior pipe work and other underground utilities.

3.6 EXCAVATION

- .1 Excavate to the elevations and dimensions indicated on the Contract Drawings and required by the work plus sufficient space to permit erection of forms, shoring, waterproofing and inspection of foundations. Excavate to clean lines to minimize quantity of fill required.
- .2 Excavations of steep or vertical walls within a confined space will require shoring or bracing.
- .3 Excavations to be in accordance with OH&S regulations.
- .4 Do not operate equipment within 1.0 m of existing structures or newly completed structures, except as approved.
- .5 Stockpile excavated material that is suitable for backfilling on-site in an area determined by the Contractor and approved by the Engineer.
- .6 Dispose of surplus excavated material not required for backfilling in an area off-site determined by the Contractor and approved by the Engineer in consultation with the Owner.

3.7 SHORING AND EMBANKMENT PROTECTION

- .1 Provide all shoring, bracing and underpinning required to protect the excavation and existing structures. Such support systems shall be designed and stamped by a professional engineer registered in the province of Saskatchewan.
- .2 If sloped embankments are utilized rather than shoring, provide slopes which are flat enough to prevent instability, as defined by OH&S and the Geotechnical Report.

3.8 FROST PROTECTION

- .1 Protect excavation, fill materials, and structures from frost damage. Soil below slab level which becomes unavoidably frozen during the excavation operation shall be promptly thawed in a manner acceptable to the Engineer.

3.9 ROCK EXCAVATION

- .1 Remove all rock within the limits of the structure or which removal is necessary as determined by the Engineer for construction of the Work.

3.10 STRUCTURE BACKFILL

- .1 Exterior backfill from the bottom of the excavation to finished grade to be native backfill in lifts no greater than 300 mm and compacted to 98% standard proctor density. Backfill to extend to the excavated original soil faces with a minimum horizontal distance at 1000 mm outwards from the building footprint.
- .2 Backfill below pipes within the Raw Water Pump House excavation with unshrinkable fill.
- .3 Do not backfill until the concrete has developed to a minimum 75% of full design strength at the 7-day break test, formwork has been removed and all work which will be covered has been inspected by the Engineer. Adequately brace foundation walls against the lateral thrusts if exterior backfill is placed prior to installing floor slab. The design and review of such support systems shall be done by a professional engineer registered in the Province of Saskatchewan, in the employ of the Contractor.
- .4 The excavation shall be free of ice, snow, debris and water at the time of backfilling.
- .5 All backfill must be completed in the dry and shall be free of large or frozen lumps, wood or other unsuitable materials. Backfilling shall not be done in freezing weather, except with the Engineer's permission, and shall not be done with frozen material or when material already in place is frozen.
- .6 Backfilling procedures shall be submitted and approved by the Engineer before proceeding with the work. Generally, do not operate earth moving equipment within 1.0 m of concrete structures for the purpose of depositing or compacting backfill material. Compact backfill adjacent to concrete walls with hand operated tampers or equipment that will not damage the structure. Carry out backfilling operations carefully so that no damage is done to waterproofed or insulated faces. Care shall be taken to build up fill evenly around structures in order to maintain unsymmetrical loading to a minimum.
- .7 If, during progress of work, tests indicate fills do not meet specified requirements, remove defective fills, replace and retest at no extra cost.
- .8 Unshrinkable fill material (fillcrete):
 - .1 Place unshrinkable fill such that the material flows into the excavations and fills the entire space. The initial lift shall be a maximum of 1 m in depth and reach final setting where the concrete is no longer fluid before additional unshrinkable fill material is placed on top of initial fill.

- .2 Take care to ensure that the pipe, pipe bedding or structure is not disturbed during backfill placement and air is not trapped beneath horizontal projections or the other locations within the excavation.
- .3 Cover unshrinkable fill material for at least 24-hours with steel plates of sufficient strength to support traffic where required until the unshrinkable fill is cured to the approval of the Engineer.
- .4 Cure to CSA A23.2.
- .9 Rectify all settlement that occurs in the backfill within 1-year maintenance period, and all damages resulting therefrom, at no cost to the Owner.

3.11 BORROW

- .1 Be responsible for locating borrow areas, sources of gravel and for their maintenance and restoration at the completion of the project.

3.12 AREA CLEANUP

- .1 Do not remove excavated material from the site without written instructions from the Engineer. Remove all building or other foreign materials from the excavation prior to backfilling. After final backfilling, remove all foreign materials from the site. Do not burn scrap lumber nor rubbish on the site; remove from the site.
- .2 Haul excavated material, not required for backfilling, to a disposal site as designated by the Owner and dump and spread in a manner to prevent site drainage problems.

3.13 DUST CONTROL

- .1 Use all means necessary to control dust on and near the work and on and near all off-site borrow areas if such dust is caused by the Contractor's operations during performance of the work or if resulting from the condition in which the Contractor leaves the site.
- .2 All surfaces shall be thoroughly moistened as required to prevent dust being a nuisance to the Owner and the public and concurrent performance of other work on-site.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
- .2 ASTM D698-91(1998), Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).

1.2 DEFINITIONS

- .1 Rock: any solid material in excess of 1.2 m³ which cannot be removed by means of a heavy-duty track excavator with a minimum operating weight of 36 t. Frozen material is not classified as rock.
- .2 Common excavation: excavation of materials that are not rock excavation or stripping.
- .3 Stripping: excavation of organic material covering original ground.
- .4 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
- .5 Waste material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
- .6 Borrow material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
- .7 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .8 Authorized over excavation: excavation of extra material required for the project authorized by the Engineer.

1.3 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Engineer's to review details of proposed dewatering or heave prevention methods, such as dikes, well points and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, or any portion of Work completed or under construction.

1.4 PROTECTION OF EXISTING FACILITIES

- .1 Protect and/or transplant existing fencing, landscaping, natural features, benchmarks, buildings, pavement, surface or underground utility lines which are to remain as directed by Engineer. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

Part 2 Products

2.1 MATERIALS

- .1 Embankment materials require approval by Engineer.
- .2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or any other unsuitable material.
- .3 Imported fill: if required, is to consist of granular material or locally available glacial till soils.
- .4 Select native fill: Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Geotechnical Consultant prior to placement.
- .5 Silt fence:
 - .1 Silt fence fabric shall be Nilex 2130 Silt Fence or approved equivalent.
 - .2 Stakes shall be adequate length to satisfy silt fence performance and maintenance requirements. The stakes shall be a minimum of 1.2 m in length with a maximum spacing of 2.5 m between stakes.
- .6 Geotextiles:
 - .1 The geotextile material shall be non-woven needle-punched polypropylene. The material specifications shall be based on minimum average roll values.
 - .2 The geotextile shall be resistant to biological and chemical environments normally found in soils.
 - .3 The geotextile shall be 10 oz in accordance with ASTM D-5261.
 - .4 Approved product: Nilex 4510 or approved equal:
 - .1 Equivalent products will not be reviewed during the tender stage.
 - .5 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to CAN/CSA G164.
 - .6 Factory seam: sewn in accordance with Manufacturer's recommendations.
 - .7 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.
- .7 Riprap:
 - .1 Riprap shall be Class 1M gradation, consisting of a graded mixture of sound, durable stone.
 - .2 Riprap shall not contain soil clods, topsoil, root, and other organic matter and shale fragments.
 - .3 Riprap must be obtained off-site and not from below the high-water level of any watercourse or waterbody.
 - .4 Riprap shall be resistant to weathering.

Part 3 Execution

3.1 SILT FENCE

- .1 Install silt fencing prior to commencing stripping, excavating, trenching, and stockpiling. The silt fence shall be installed to prevent sediment from passing from one side of the barrier to the other.
- .2 Posts shall be spaced a maximum of 2.5 m apart and shall be driven vertically into the ground to a minimum depth of 600 mm.
- .3 A trench measuring approximately 200 mm wide by 200 mm deep shall be excavated along the entire line of stakes. The trench shall be on the side of the stakes where grading work is to be conducted.
- .4 The geotextile from the silt fence shall extend into the trench a minimum of 300 mm. The fabricated silt fence shall be installed without sags and have an overlap of 450 mm wherever its length is extended.
- .5 The trench shall be backfilled and mechanically compacted to existing grade to hold the anchored geotextile firmly in place. The completed silt fence shall have a minimum height of 600 mm above the ground surface.

3.2 STRIPPING OF TOPSOIL

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Engineer.
- .2 Commence topsoil stripping of areas as directed by Engineer.
- .3 Strip topsoil to depths as directed by Engineer. Retain grasses and retain as topsoil on site. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Engineer. Stockpile height not to exceed 2 m.
- .5 After the stockpiles are measured by the Engineer, Contractor will transfer materials to the disposal pit, as directed by Engineer.

3.3 GRADING

- .1 Rough grade to levels, profiles and contours allowing for surface treatment as indicated.
- .2 Grade ditches to depth as indicated on Drawings.
- .3 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .4 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
 - .1 Building Areas: 98% of standard Proctor density at optimum moisture content.
 - .2 Roadway Areas: 98% of standard Proctor density at optimum moisture content.
 - .3 Landscape Areas: 95% of standard Proctor density at optimum moisture content.
- .5 Do not disturb soil within branch spread of trees or shrubs to remain.

- .6 Subgrade fill, if required, should preferably consist of granular material or locally available glacial till soils. The fill should be placed in thin lifts (maximum 150 mm loose) and compacted to a minimum of 96% of standard Proctor density at optimum moisture content. The subgrade fill should be approved by the Geotechnical Consultant prior to placement.

3.4 GEOTEXTILE

- .1 The geotextile rolls must be tagged to identify lot and batch, unique roll number, roll dimension, manufacturer and material type.
- .2 All geotextiles shall be handled in a manner to ensure they are not damaged.
- .3 On slopes, the geotextiles shall be anchored in the trench and then rolled down the slope where practical.
- .4 The geotextiles shall be deployed in a manner to continually keep the geotextile sheet in sufficient tension to reduce folds or wrinkles.
- .5 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .6 All geotextiles left exposed at the end of a workday shall be weighted with sandbags or the equivalent.
- .7 Overlap each successive strip of geotextile as per Manufacturer's recommendations.
- .8 Geotextiles shall be cut using an approved cutter. Special care should be taken to protect other geosynthetic materials from damage.
- .9 Protect installed geotextile material from displacement, damage, or deterioration before, during, and after placement of material layers.
- .10 After installation, cover with overlying layer of hard surface material within 4-hours of placement.
- .11 Replace damaged or deteriorated geotextile to approval of Engineer.
- .12 No vehicles permitted directly on geotextile.

3.5 RIPRAP

- .1 Fine grade area to be riprapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .2 Place 10 oz non-woven geotextile on prepared embankment before placing riprap. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .3 Placement:
 - .1 Place riprap stones in a manner approved by Engineer to secure surface and create a stable mass.
 - .2 Place riprap and locations indicated on drawings to thickness, and details as indicated.
 - .3 Place larger stones at bottom of slopes.
- .4 Hand placing:
 - .1 Use larger stones for lower courses and as headers for subsequent courses.

- .2 Stagger vertical joints and fill voids with rock spalls or cobbles.
- .3 Finish surface evenly, free of large openings and neat in appearance.

3.6 TESTING

- .1 Cost of testing will be paid in accordance with Division 01.
- .2 Submit testing procedure, frequency of tests to Engineer for approval.
- .3 The minimum number of tests required is as follows:
 - .1 For embankment under roadways or parking areas, one compaction test for every 1000 m² and each 150 mm lift, or a minimum of one compaction test for every 150 mm lift if the embankment area where embankment area is less than 1,000 m², and a minimum of one test per day.

3.7 SURPLUS MATERIAL

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping as directed by Engineer.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

- .1 Excavating and backfilling to conform to the following codes and standards:
 - .1 Saskatchewan Labour (Occupational Health and Safety Act and Regulations).
 - .2 Local Codes and Bylaws.

1.2 DEFINITIONS

- .1 Rock excavation: excavation of massive ledge rock, boulders or bedrock which cannot be removed by a track excavator with a minimum operating weight of 36 t and a minimum bucket capacity of 1.2 m³ without drilling and blasting.
- .2 Boulders: all forms of rock, detached masses of rock, boulders, concrete or masonry, greater than 600 mm in average diameter, that can be removed by a track excavator with a minimum operating weight of 36 t and a minimum bucket capacity of 1.2 m³ without drilling or blasting.
- .3 Common excavation/trench excavation: excavation of all materials which are not included under definition of rock excavation or boulder excavation.
- .4 Waste material: excavated material unsuitable for use in work or surplus to requirements.
- .5 Unsuitable material: very weak, compressible or saturated materials which in the opinion of the Engineer are not suitable for fill.
- .6 Select native material: material excavated from the trench from which all boulders larger than 400 mm in maximum dimension, large roots, stumps or other debris that would prevent consolidation of the backfill have been removed.
- .7 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.
- .8 Topsoil: humus, peat or other material containing organics which make up the top layer of the soil.
- .9 Granular trench fill material: material such as sand, natural gravel and reclaimed concrete aggregate, free of reclaimed asphalt which meets the specifications set out herein.
- .10 Borrow material: suitable material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of work.
- .11 Pipe surround: granular material 100 mm below the bottom of pipe to a height of 150 mm above the top of the pipe or as shown on the Drawings.
- .12 Pipe bedding: granular material within the pipe zone that supports the pipe and other appurtenances which meets the specifications set out herein.
- .13 Haunch: portion of the pipe zone from the bottom of the pipe to the springline or midpoint of the pipe.

- .14 Tunnelling: the process of installation of a pipeline by means of coring, auguring or directional drilling where an open cut excavation is not employed.
- .15 Course stabilizing gravel: clean angular material required for stabilization of trench bottom due to over excavation of unsuitable trench bottom conditions.

1.3 SUBMITTALS AND SAMPLES

- .1 Provide submittals and samples in accordance with Division 01.
- .2 Provide sieve analysis for all specified products.

1.4 PROTECTION OF EXISTING FEATURES

- .1 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to commencing excavation work, notify applicable owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures.
 - .3 Confirm locations of buried utilities by careful test excavations. Hand expose all shallow utilities.
 - .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .5 Where utility lines or structures exist in area of excavation, obtain direction of Engineer before removing or re routing.
 - .6 Record location of maintained, rerouted and abandoned underground lines.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Engineer, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, irrigation infrastructure, pavement, survey benchmarks and monuments which may be affected by work.
 - .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Engineer.
 - .3 Where required for excavation, cut roots or branches as approved by Engineer.
 - .4 If during excavation, irrigation infrastructure is uncovered and needs to be temporarily or permanently removed and relocated, immediately notify the Engineer. Do not remove any such piping until inspected and approved by Engineer.

1.5 SHORING, BRACING AND UNDERPINNING

- .1 Where shoring, bracing or underpinning is required:
 - .1 Protect existing features in accordance with applicable local regulations.
 - .2 Engage services of qualified professional engineer who is registered or licensed in the province in which work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for work.
 - .3 Submit design and supporting data at least 2-weeks prior to commencing work.

- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the province in which the work is undertaken.
- .5 Professional Engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where engineer is employee of contractor, in which case contractor shall submit proof that work by professional engineer is included in contractor's insurance coverage.

Part 2 Products

2.1 SELECT NATIVE BACKFILL MATERIAL

- .1 Approved material that does not contain boulders or rocks larger than 400 mm diameter, organic soils, frozen lumps of earth, rubble or debris from trench excavation.

2.2 UNSHRINKABLE FILL MATERIAL

- .1 In accordance with Division 31.

2.3 GRANULAR TRENCH FILL MATERIAL

- .1 Where required, provide granular material for trench fill to the following gradation limits.

Sieve Size	% Passing
28 mm	100
20 mm	90 to 100
12.5 mm	70 to 100
5 mm	45 to 85
2 mm	30 to 65
0.8 mm	15 to 40
0.4 mm	12 to 30
0.16 mm	9 to 20
0.0075 mm	7 to 15

2.4 COARSE STABILIZING GRAVEL

- .1 Provide angular rock material for stabilization of trench bottom to the following gradation limits:

Sieve Size	% Passing
25 mm	100
20 mm	90 to 100
10 mm	25 to 60
5 mm	0 to 10
2.5 mm	0 to 5

2.5 PIPE BEDDING AND SURROUND MATERIAL

- .1 Provide pipe surround material to the following gradation limits:

Sieve Size	% Passing
10 mm	85 to 100
5 mm	75 to 100
2 mm	55 to 90
0.4 mm	20 to 50
0.075 mm	0 to 5

2.6 PEA STONE

- .1 Where specified, provide pea stone material to the following gradation limits:

Sieve Size	% Passing
14 mm	100
10 mm	90 to 100
5 mm	0 to 20
2.5 mm	0 to 5
1.25 mm	0 to 2.5

2.7 TRAFFIC GRAVEL

- .1 Traffic gravel, where specified, shall be to MHI Type 101, graded within the following limits:

Sieve Size	% Passing
75 mm	100
50 mm	50-85
5 mm	0-40
2 mm	0-25

- .2 Fractured face %: minimum 50%.
- .3 Crushed aggregate shall consist of sound, hard durable particles of sand, gravel and rock free from elongated or laminated particles injurious amounts of flaky particles, soft shales, coal ironstone, clay lumps, organic material or other deleterious substances.
- .4 Flat and elongated particles of coarse aggregate: to ASTM D4791:
- .1 Greatest dimension to exceed five times their least dimension.
- .5 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
- .1 Natural sand.
- .2 Manufactured sand.
- .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

- .6 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

- .1 Crushed rock.
- .2 Gravel and crushed gravel composed of naturally formed particles of stone.

Part 3 Execution

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow from surfaces to be excavated within limits indicated.

3.2 STRIPPING OF TOPSOIL

- .1 In accordance with Division 31.

3.3 STOCKPILING

- .1 Stockpile fill materials in areas designated by Engineer. Stockpile granular materials in manner to prevent segregation.
- .2 Excavated material that cannot be piled along the trench is to be stockpiled and returned for backfilling as required.
- .3 Protect fill materials from contamination.

3.4 SHORING, BRACING AND UNDERPINNING

- .1 Where shoring, bracing or underpinning is required:
 - .1 Obtain permit from authority having jurisdiction for temporary diversion of water course.
 - .2 Construct temporary works to depths, heights and locations as indicated or directed by Engineer.
 - .3 Install shoring so that it does not extend below the springline of the pipe. Do not locate shoring closer than 150 mm to the widest section of the installed pipe. When it is necessary to place the shoring below the pipe springline, raise the shoring in 600 mm lifts and compact each lift to fill the void left by the raised sheeting.
 - .4 When shoring must be left in place, cut so that no shoring remains closer than 900 mm to the ground surface.
 - .5 Remove shoring in a manner which permits compaction of the backfill.
- .2 Upon completion of substructure construction:
 - .1 Remove shoring and bracing.
 - .2 Remove excess materials from site and restore water courses as indicated or as directed by Engineer.

3.5 DEWATERING AND HEAVE PREVENTION

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

- .2 Where requested by Engineer, submit for his review details of proposed dewatering or heave prevention methods, such as dikes, well points and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut offs or other means.
- .4 Protect open excavations against flooding and damage due to surface run off.
- .5 Dispose of water in manner not detrimental to public and private property, or any portion of work completed or under construction, in accordance with applicable permit requirements, and regulations and guidelines of authorities having jurisdiction. Do not discharge to sewer system.
- .6 When required, provide flocculation tanks, settling basins or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.
- .7 All water encountered in the trench to be pumped or bailed out. Do not use pipe to drain water unless approved by the Engineer.

3.6 EXCAVATION

- .1 Advise Engineer at least 7-days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations and dimensions as indicated or as directed by Engineer.
- .3 Remove concrete, masonry, paving, walks, demolished foundations, rubble and other obstructions encountered during excavation.
- .4 Excavation must not interfere with 45° angle of bearing from bottom of any footing.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 For trench excavation, unless otherwise authorized by Engineer in writing, do not excavate more than 50 m of trench in advance of installation operations and do not leave open more than 5 m at end of day's operation.
- .7 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Engineer.
- .8 Dispose of surplus and unsuitable excavated material off site or as approved on site by Engineer.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Remove unsuitable material from trench bottom to extent and depth as directed by Engineer.
- .12 Backfill over excavation to the level of normal bedding with coarse stabilizing gravel material.

- .1 Backfill with unshrinkable fill material from invert of pipe to undisturbed soil at penetrations through structures.
- .13 Correct unauthorized over excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with course stabilizing gravel compacted to not less than 97% of Standard Proctor Dry Density.
- .14 The trench bottom is to provide a pipe vertical alignment within ± 5 mm of the grade indicated on the drawings.
- .15 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Engineer.
- .16 Pile excavation material alongside the trench, provided working space is adequate. Ensure excavation material does not spill onto private properties.
- .17 Remove ledge rock, boulders and large stones to provide a minimum clearance of 150 mm below the pipe.
- .18 Where the maximum trench width is exceeded provide special bedding as directed by the Engineer.
- .19 Night work, from sunset to sunrise, will only be allowed if written permission is given by the Engineer. Work carried out at night to have adequate lighting to enable the work to be done in a satisfactory manner. No pipe shall be laid nor work done if in the opinion of the Engineer there is insufficient light to perform the work safely and satisfactorily.

3.7 BACKFILLING

- .1 General:
 - .1 Do not proceed with backfilling operations until Engineer has inspected and approved installations.
 - .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
 - .3 Do not use backfill material which is frozen or contains ice, snow or debris.
 - .4 Backfill around installations.
 - .5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness. Compact each layer before placing succeeding layer.
 - .6 Place bedding and surround material as specified elsewhere.
- .2 Backfill within pipe surround:
 - .1 Backfill pipe with pipe surround material in uniform layers and compacted by mechanical means for the full width of the trench. Backfill in layers not exceeding 150 mm in thickness and compacted to completely fill spaces under and adjacent to the pipe.

- .2 Where specified, backfill with unshrinkable fill material such that the material flows into the excavation and fills the entire space under the pipe. Place unshrinkable fill material to the springline of the pipe. Ensure that the pipe or pipe bedding is not disturbed during backfill placement and air is not trapped beneath horizontal projections or other locations within the pipe surround.
- .3 Flexible pipe (CSP, HDPE, PVC): place and compact pipe surround material from 100 mm below bottom of pipe to a minimum of 300 mm above top of pipe or as indicated on drawings.
- .4 Compact the pipe surround material to 98% Standard Proctor Dry Density.
- .3 Backfill above the pipe surround:
 - .1 Select native backfill or granular trench fill material:
 - .1 Backfill in uniform layers not exceeding 150 mm thickness required to obtain an average of 98% Standard Proctor Dry Density with no more than one test falling below 97% Standard Proctor Dry Density. Backfill to previous ground level or as otherwise indicated by Engineer.
 - .2 Control the moisture content of the in situ backfill material to within $\pm 3\%$ of the in-situ material in the adjacent trench walls. Supply and add water or dry the in-situ backfill material as required to meet the moisture specification.
 - .3 Where excavated trench material is not suitable for backfilling, it shall be hauled and disposed of as directed by Engineer and imported backfill material shall be provided and placed.
 - .4 Provide and place backfill material arising from a shortage of backfill material due to the construction operation or removal and disposal of rock, boulders or other material.
 - .5 Haul suitable material from elsewhere on the project site or, where this is not possible, provide material from other sources to make up such deficiencies in backfill material.
- .4 Granular trench fill material:
 - .1 Where requested by the engineer, provide granular trench fill material.
 - .2 Backfill in uniform layers not to exceed the thickness required to obtain the specified density. The maximum allowable layer thickness shall be 150 mm of granular materials unless otherwise approved by the Engineer.
 - .3 Compact backfill to a minimum of 98% Standard Proctor Dry Density and within 1% of optimum moisture content.
- .5 Unshrinkable fill material:
 - .1 Place unshrinkable fill such that the material flows into the excavations and fills the entire space. The initial lift shall be a maximum of 1 m in depth and reach final setting where the concrete is no longer fluid before additional unshrinkable fill material is placed on top of initial fill.
 - .2 Take care to ensure that the pipe or pipe bedding is not disturbed during backfill placement and air is not trapped beneath horizontal projections or the other locations within the excavation.

- .3 Cover unshrinkable fill material for at least 24-hours with steel plates of sufficient strength to support traffic where required. Where road traffic is not to be accommodated, cover and fence the excavation for 24-hours until the unshrinkable fill is cured to the approval of the Engineer.

3.8 SURFACE MAINTENANCE DURING CONSTRUCTION

- .1 Maintain all trench surfaces and working surfaces affected by construction until the project is accepted by the Owner.
- .2 Finish berms over trenches as specified prior to acceptance. Provide and place material to fill depressions resulting from the settlement of backfill.
- .3 Maintain gravelled surfaces free of potholes and washboard conditions. Grade surfaces to eliminate irregularities as often and as soon as they occur.
- .4 Mark locations which cannot be immediately reinstated to the specified standard by approved means to warn traffic of hazards until defects are rectified.
- .5 Maintain all surfaces as required to prevent dust being a nuisance to the public and concurrent performance of other work on-site.

3.9 RESTORATION

- .1 Upon completion of work, dispose of excess materials stockpiled on site, remove waste materials and debris, trim slopes and correct defects as directed by Engineer.
- .2 Replace topsoil and seed areas impacted by construction activities.
- .3 Reinstate gravel roads to elevation which existed before excavation.
- .4 Clean and reinstate areas affected by work as directed by Engineer.

3.10 TRENCH SETTLEMENT DURING WARRANTY PERIOD

- .1 Replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls during the warranty period. Refill settled trench areas with specified backfill material.

3.11 DISPOSAL OF BOULDERS

- .1 Dispose of boulders by:
 - .1 Transportation to off-site and buried at location determined by the Contractor and approved by Owner and Engineer.

3.12 TESTING

- .1 Testing of trench backfill will be carried out by an independent laboratory.
- .2 Cost of tests will be paid for by the Contractor under the cash allowance.
- .3 Any backfill layer not meeting the specifications shall be scarified and recompacted.

- .4 The minimum number of tests required is as follows:
 - .1 One compaction test of every 10 linear metres of trench for every 150 mm lift of backfill, or a minimum of one a day.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 The work includes but is not limited to the following:
 - .1 Supply of a well pump to be used for the temporary pumping system for the Riverview Golf Club pumping system.
 - .2 Supply of a well pump to be used for the temporary pumping system for the Town of Outlook Raw Water Supply System.

1.2 REFERENCES

- .1 All work to be completed to the following latest applicable standards except where higher standard is specified:
 - .1 American Water Works Association (AWWA).
 - .2 American Society for Testing Materials (ASTM).
 - .3 American Society of Mechanical Engineers (ASME).
 - .4 American National Standards Institute (ANSI).
 - .5 Air Movement & Control Association (AMCA).
 - .6 Canadian Standards Association (CSA).
 - .7 Food and Drug Administration (FDA).
 - .8 National Sanitary Foundation (NSF).

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 The Contractor shall submit shop drawings and product information for the pumping equipment in accordance with Section 01 10 00 - General Requirements.
- .2 Pump data to include:
 - .1 Manufacturer's name, type, model, year, capacity and serial number.
 - .2 The manufacturer's specifications for all equipment supplied.
 - .3 Performance curves, which include differential head, capacity, efficiency, water NPSHR and brake horsepower. For each pump, submit performance curves for speeds of 3450, 3400, 3350 and 3300 rpm.
 - .4 Outline and arrangement drawings.
 - .5 Cross-sectional drawings.
 - .6 Materials of construction.
 - .7 Details of operation, service and maintenance.
 - .8 Recommended spare parts list with names and addresses of suppliers.
- .3 Motor data to include:
 - .1 Manufacturer's name, type, rating, model, year and serial number.
 - .2 The manufacturer's specifications for all equipment supplied.
 - .3 The load, efficiency, speed, torque current and power factor curves.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Provide Operation and Maintenance data for incorporation into the manual specified in Section 01 78 23 - Operating and Maintenance Data.
- .2 Data to include:
 - .1 Pump Manufacturer's name, type, model, year, capacity and serial number.
 - .2 Motor Manufacturer's name, type, rating, model, year and serial number.
 - .3 Manufacturer's specifications for all equipment supplied.
 - .4 Details of installation, operation, servicing, lubrication and maintenance.
 - .5 Recommended spare parts list with names and addresses of suppliers.

1.5 SERIAL NUMBERS AND NAMEPLATES

- .1 Each piece of equipment shall be stamped with a serial number, prior to shop performance testing.
- .2 Each piece of equipment shall be provided with substantial stainless steel or brass nameplates attached to the unit, clearly inscribed with the Manufacturer's name, year of manufacture and the principal rating data.
- .3 The motor nameplate shall include CSA approval and indicate motor is designed for operation by a variable frequency drive.
- .4 The pump nameplates shall have the capacity at the rated point inscribed in litres a second and the head in metres.

Part 2 Products

2.1 SUBMERSIBLE PUMPS

- .1 Number of units: one.
- .2 Town of Outlook Well Pump for temporary pumping:
 - .1 Type: submersible turbine suitable for installation in exterior manhole for temporary pumping systems.
 - .2 Minimum hydraulic efficiency: 60%.
 - .3 Casing/bowls: stainless steel.
 - .4 Impellers/diffusers: stainless.
 - .5 Pump shaft: stainless steel.
 - .6 Discharge connection: stainless steel, 150 mm NPT.
 - .7 Valve: built-in non-return valve.
 - .8 Motor adaptor: bronze or stainless steel.
 - .9 Pump recovery system: 10 mm ($\frac{3}{8}$ ") stainless steel cable.

- .3 Motor:
 - .1 Stator: stainless steel.
 - .2 Water filled.
 - .3 Hermetically sealed stator.
 - .4 Non-overloading at any point on the curve.
 - .5 Nominal speed: 3450 rpm.
 - .6 Motor suitable for operation by an across the line starter, CSA approved.
- .4 Electrical cable: continuous without splicing to the termination in the well head and sized in accordance with Manufacturer's and CSA requirements. Cable is to be fastened to the vertical discharge piping at regular intervals according to the Electrical Code.
- .5 Tag: Town of Outlook Raw Water Supply Pump:
 - .1 Flow capacity: 50 L/s.
 - .2 Total dynamic head: 70 m.
 - .3 Minimum motor size: 60 hp, 460 V, 3-phase 60 Hz.
 - .4 Acceptable product/Vendor:
 - .1 Franklin Submersible Turbine STS Series; or
 - .2 Approved equal.
- .6 Riverview Golf Club Well Pump for temporary pumping:
 - .1 Type: submersible turbine suitable for installation in exterior manhole for temporary pumping systems.
 - .2 Minimum hydraulic efficiency: 60%.
 - .3 Casing/bowls: stainless steel.
 - .4 Impellers/diffusers: stainless.
 - .5 Pump shaft: stainless steel.
 - .6 Discharge connection: stainless steel, 150 mm NPT.
 - .7 Valve: built-in non-return valve.
 - .8 Motor adaptor: bronze or stainless steel.
 - .9 Pump recovery system: 10 mm ($\frac{3}{8}$ ") stainless steel cable.
- .7 Motor:
 - .1 Stator: stainless steel.
 - .2 Water filled.
 - .3 Hermetically sealed stator.
 - .4 Non-overloading at any point on the curve.
 - .5 Nominal speed: 3450 rpm.
 - .6 Motor suitable for operation by an across the line starter, CSA approved.
- .8 Electrical cable: continuous without splicing to the termination in the well head and sized in accordance with manufactures and CSA requirements. Cable is to be fastened to the vertical discharge piping at regular intervals according to the Electrical Code.

- .9 Tag: Riverview Golf Club Water Supply Pump:
 - .1 Flow capacity: 44 L/s.
 - .2 Total dynamic head: 43 m.
 - .3 Maximum motor size: 30 hp, 460 V, 3-phase 60 Hz.
 - .4 Acceptable product/Vendor:
 - .1 Franklin Submersible Sand Fighter; or
 - .2 Approved equal.

2.2 CHECK VALVE

- .1 Material: stainless steel.
- .2 Size: 75 mm or larger.
- .3 Drain: break off drain plug and four spare break off plugs.
- .4 Acceptable Manufacturer:
 - .1 Flowmatic; or
 - .2 Approved equal.

2.3 BOLTS, NUTS AND WASHERS

- .1 Buried Bolts: 304 stainless steel to ASTM A193, grade B8.
- .2 Buried Nuts: 304 stainless steel to ASTM A194, grade 8.
- .3 Non-Buried Bolts: zinc plated to ASTM A193, grade B7.
- .4 Non-Buried Nuts: zinc plated to ASTM 194, grade 2H.

2.4 POWER SUPPLY

- .1 Install wiring for the temporary system in accordance with Electrical Code requirements.

Part 3 Execution

3.1 INSTALLATION

- .1 Assemble and/or install all pumping equipment in strict accordance with manufacturer's and supplier's instructions:
 - .1 Any damage resulting from either failure to observe the installation instructions or as a result of proceeding with the work without complete knowledge of how it is to be done will be the Contractor's responsibility.
 - .2 Contractor is to provide digital photos on a USB of the installation of the pitless adaptor, pump, drop pipe and instrumentations at the completion of work.

- .2 Make equipment installation and connections by a qualified journeyman to the best standard:
 - .1 Carry out work to produce a neat, accurate, secure and functional installation.
 - .2 Repair at own expense, any damage done to the installation or materials while carrying out the Work.
- .3 Install all electrical and controls equipment identified in the documents. Provide the required wiring, conduits, fastenings and supports for a complete operational system. Installation shall meet the requirements of the Canadian Electrical Code and these documents. The more stringent requirement shall apply.

3.2 FIELD TESTING

- .1 Complete installation to the requirements of the equipment Manufacturer.
- .2 Provide all testing equipment required to measure the following:
 - .1 Pressure.
 - .2 Amperage.
 - .3 Voltage.
- .3 Operate and adjust the equipment and take readings, of the pump/motor operating characteristics at:
 - .1 Shut-off head.
 - .2 Full rated capacity.
 - .3 One intermediate point.
- .4 The pump Manufacturer/supplier will certify the pump's operation for warranty purposes.
- .5 Use only personnel who have taken an active part in the actual installation of the system. Do not designate a subtrade as representative at any time during construction prior to final inspection.

3.3 FINAL INSPECTION

- .1 Final inspection will be made by the Engineer only after the Contractor has advised that the equipment installation is in order and that the system has been operated.
- .2 The Engineer will request that the equipment be operated to demonstrate that it will perform as specified. The Engineer will note deficiencies, and if possible, the deficiency will be corrected immediately by the Contractor. All deficiencies that cannot be corrected at the time of inspection will be noted by the Engineer who will advise the Contractor of these deficiencies in writing. The Contractor shall correct the deficiencies as soon as possible and advise the Engineer of their correction. Should the deficiencies be of a sufficiently serious nature to require the work to be reinspected, the cost of the inspection shall be borne by the Contractor.

END OF SECTION

Part 1 General

1.1 SUBMITTALS AND SAMPLES

- .1 Submit Shop Drawings and product data for pipe valves and fittings in accordance with Division 01.
- .2 Provide marked up field record drawings and sketches as necessary for the Engineer to produce accurate, complete office record drawings.
- .3 Provide detailed operating and maintenance instructions for all equipment installed.
- .4 Provide detailed lists of any special or proprietary tools or equipment which are required to assemble, disassemble, operate or maintain any device installed on this project.
- .5 Where requested by Engineer, provide certified test results for materials to be employed.
- .6 Submit detailed procedure for hot-tapping into existing force main if required. Plan to include:
 - .1 Materials to be used.
 - .2 Contractor personnel or subcontractor performing the tie-in.
 - .3 Method for excavating and supporting existing pipe and proposed hot-tapping saddle and valve.
 - .4 Method of cutting existing pipe.
 - .5 Excavation dewatering methods.
 - .6 Emergency plan if leakage or failure of existing pipe occurs.

1.2 MATERIAL CERTIFICATION

- .1 Submit Manufacturer's test data and certification at least 2-weeks prior to commencing Work.
- .2 Certification to be marked on pipe.

1.3 SCHEDULING OF WORK

- .1 Schedule work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions and adhere to schedule approved by Engineer.
- .3 Notify Engineer and building manager a minimum of 24-hours in advance of any interruption in service.

Part 2 Products

2.1 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- .1 Material: PE 4710 in accordance with AWWA C906.
- .2 Dimension ratio: as noted on the drawings.

- .3 Polyethylene Compound shall meet ASTM D3350 and shall meet the classification and property requirements in Table 2 of ASTM D3350 and shall have PPI TR-4 HDB listings at 73°F (23°C) of 1600 psi, HDS listing at 73°F (23°C) of 1000 psi and HDB listings at 140°F (60°C) of 1000 psi.
- .4 The raw material shall contain 2-3% carbon black, well dispersed in accordance with ASTM F714.
- .5 The pipe shall contain no recycled compound except that generated in the Manufacturer's own plant from resin of the same specification from the same raw material supplier.
- .6 The minimum cell classification shall be PE 445474C for PE 4710 materials per ASTM D3350/F714:
 - .1 Marking:
 - .1 The following shall be continuously indent printed on the pipe, or spaced at intervals not exceeding 1.5 m.
 - .1 Name and/or trademark of the pipe.
 - .2 Nominal pipe size.
 - .3 Pressure rating and/or DR number.
 - .4 The letters "PE" followed by the polyethylene type and category, as specified by ASTM D-1248, followed by the hydrostatic design basis.
 - .5 Manufactured standard design basis.
 - .6 A production code from which the date and place of manufacturer can be determined.
- .7 Minimum pipe bend as per manufacturer specifications.

2.2 JOINING METHODS

- .1 Whenever possible the polyethylene pipe should be joined by the method of thermal butt-fusion, as outlined in ASTM-F2620, Heat Fusion Joining of Polyethylene Pipe and Fittings. Butt-fusion joining of pipe and fittings shall be performed in accordance with the procedures recommended by the manufacturer. The temperature of the heater plate should not exceed 210°C ±5°C (410°F ±10°F) and the joining pressure should not exceed 25 lb/in² of projected end area, excluding an allowance for friction.
- .2 The polyethylene pipe may be adapted to fittings or other systems by means of an assembly consisting of a polyethylene stub-end, butt-fused to the pipe, a backup flange of ductile iron, made to Class 150, ANSI B16.5 dimensional standards with exceptions, bolts of compatible material and a gasket of suitable red rubber or asbestos-rubber compound cut to fit the joint. In all cases, the bolts shall be drawn up evenly and in line.
- .3 Polyethylene pipes of the same outside diameter but different wall thicknesses shall be joined by means of a flange assembly as designated above or by engineered reducer.
- .4 The pipe supplier shall be consulted to obtain machinery and expertise for the joining by butt-fusion of polyethylene pipe and fittings. No pipe or fittings shall be joined by fusion by any Contractor unless he is adequately trained and qualified in the techniques involved. The pipe shall contain no recycled materials.
- .5 Electrofusion couplings are not approved for use.

- .6 Tracer wire:
 - .1 Tracer wire to comply with ASTM-D-1248 and to be suitable for open cut trench installation and trenchless installation:
 - .1 Open Trench: Tracer wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb break load, with minimum 30 mil HDPE insulation thickness.
 - a. Directional drilling/boring: tracer wire shall be #12 AWG copper clad steel, extra high strength with minimum 1150 lb break load, with minimum 30 mil HDPE insulation thickness.
 - .2 All tracer wire termination points must utilize an approved tracer wire box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.
- 2. Provide product data to Engineer for review 2-weeks prior to installation.

2.3 **POLYETHYLENE PIPE FITTINGS**

- .1 The most recent edition of ANSI/AWWA C906.
- .2 Polyethylene fittings for use with the pipe shall be heat fusion fittings made of the same material and wall thickness of the pipe and be completely fibreglass reinforced as required to achieve at least the same pressure rating as the pipe to which it is to be joined.
- .3 Flanged fittings shall comprise of a stub end, butt fused to the pipe end, together with a slip-on flange which shall comply with ANSI B 16.5 bolt circles for the highest rating for the pipe size and shall be manufactured from ductile iron and epoxy coated. The securing bolts, nuts, and washers shall be made of 316 stainless steel and be of a size and length to suit the flanges.

2.4 **SACRIFICIAL ANODES**

- .1 All buried metals such as valves, hydrants and other metallic appurtenances to be cathodically protected using package anodes to the following:
 - .1 Type: magnesium.
 - 3. Size: 7.7 kg.
 - .2 Cast with perforated steel strap core mechanically secured and silver soldered to anode lead wire.

2.5 **CORROSION PROTECTION**

- .1 In addition to anode protection, all buried nuts, bolts, transition couplings, restrainers, and metal fittings to be coated with Denso Mastic and Denso Tape.
- .2 Other corrosion protection method to be approved by the Engineer.

2.6 **PIPE BEDDING AND BACKFILL MATERIAL**

- .1 Pipe bedding and backfill material in accordance with Division 31.

2.7 VALVES

- .1 Gate valves (GAV):
 - .1 Sizes as indicated on drawings.
 - .2 To AWWA C509.
 - .3 General: direct buried valves.
 - .4 Type: ductile iron body fusion epoxy coating interior and exterior surfaces.
 - .5 Stem: non-rising stem.
 - .6 Disk: ductile iron wedge fully encapsulated with molded rubber.
 - .7 End connection: 125 lb ANSI flanged.
 - .8 Operating nut: 50 mm AWWA standard wrench nut.
 - .9 Operation: open with a counter-clockwise rotation.
 - .10 Approved Manufacturers:
 - .1 Mueller.
 - .2 Clow.
 - .11 Valve boxes and covers:
 - .1 Adjustable design with cast iron upper section and PVC lower section.
 - .2 Cast iron top extensions with a minimum length of 300 mm.
 - .3 Approved Manufacturers:
 - .1 Norwood Foundries Ltd.
 - .2 Titan Foundries Ltd.

2.8 RESTRAINED COUPLINGS

- .1 Body: ductile iron with fusion bonded epoxy coating.
- .2 Gaskets: SBR (Buna S) or EPDM Rubber per ASTM D2000.
- .3 Fasteners: corrosion resistant, HSLA steel bolt and nuts.
- .4 Approved Products:
 - .1 Georg Fischer (GF Piping Systems) Multi/Joint 3007.

2.9 NUTS AND BOLTS

- .1 Direct buried or submerged service stainless steel bolts and nuts on direct buried or submerged applications conforming to ASTM A193 Grade B8 or B8M.
- .2 Exposed service galvanized carbon steel bolts conforming to ASTM A307 Grade B7 with galvanized carbon steel nuts conforming to ASTM A307 Grade 2H, semi-finished hex head.

2.10 CLEAN OUT

- .1 Provide a swab launch structure as shown on the Drawings and noted below:
 - .1 Manhole barrel sections: 900 mm dia.
 - .2 TF-39 Standard Manhole frame and cover for a 1050 mm manhole.

- .3 HDPE pipe, elbows, flange fittings, and blind flange c/w 50-H1 flushing connection.
 - .1 Pressure rating and DR of HDPE pipe as indicated on Drawings.
- .4 100 mm drain, gate valve c/w non-rising stem and all appurtenances noted in the Gate Valves section of this specification.
- .5 Crushed rock (1.0 m³) wrapped in 10 oz non-woven geotextile.

Part 3 Execution

3.1 PREPARATION

- .1 Pipes and fittings to be clean and dry.
- .2 Prior to installation, obtain Engineer's approval of pipes and fittings.

3.2 TRENCHING

- .1 Do trenching work, in accordance with Division 31.
- .2 Trench alignment and depth require approval from Engineer prior to placing bedding material or pipe.

3.3 GRANULAR BEDDING

- .1 Place granular bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 98% corrected maximum dry density maximum density to ASTM D698.
- .6 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material or unshrinkable fill as noted in Division 31.

3.4 PIPE INSTALLATION

- .1 Obtain Engineer's approval of backfill and bedding materials and installation procedures prior to pipe installations.
- .2 Lay pipes to Manufacturer's standard instructions and specifications.
- .3 Join pipes in accordance with Manufacturer's recommendations.
- .4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .5 Do not exceed permissible deflection at joints as recommended by pipe Manufacturer.

- .6 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .7 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .8 Align pipes carefully before jointing.
- .9 Do not lay pipe on frozen bedding.
- .10 Remove any pipe which has floated due to trench flooding and reinstall only after acceptable trench and bedding conditions have been re-established.
- .11 Install all special structures such as air release valves, drains, blow-offs, hydrants, swabbing facilities and valve chambers at the locations indicated and in accordance with the Contract Documents.
- .12 Protect pipe and fittings from excessive exposure to direct sunlight or other damage. Replace any pipe or fittings which have become discoloured, cracked or otherwise marred or damaged.
- .13 Ensure proper operation of all fittings and appurtenances having moving parts both prior to and after installation.
- .14 Coat direct buried metallic objects with a Denso paste and tape, or as approved.

3.5 TIE-IN TO EXISTING FORCEMAINS

- .1 Hydrovac to locate the existing forcemain. Caution shall be exercised in uncovering existing pipe to ensure that damage does not occur.
- .2 Provide minimum 48-hours written notice to the Engineer prior to commencing tie-in work.
- .3 Ensure Hydrovac equipment is readily available to remove any wastewater trapped in the existing forcemain when cutting into the existing forcemain to tie-in the new forcemain pipe.
- .4 Make good at no expense to the Owner all damages resulting from an unsuccessful tie-in or failure of material installed to complete tie-in or damage to existing structures or works caused during performance of the tie-in.

3.6 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Provide a valve box on each valve which is direct buried.
- .3 Minimum overlap between the top and bottom sections of the valve boxes shall be 150 mm.
- .4 Install restraints, where required in accordance with Manufacturer's recommendations.

3.7 COUPLINGS

- .1 Install coupling, and stiffening inserts as required, to Manufacturer's instructions.

3.8 PIPE SURROUND

- .1 Upon completion of pipe laying and after Engineer has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated:
 - .1 Do not dump material within 2 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 98% of maximum dry density.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 98% of maximum dry density.

3.9 BACKFILL

- .1 In accordance with Division 31.

3.10 PRESSURE AND LEAK TESTING

- .1 This section refers to the hydrostatic testing of all new and modified HDPE pipes.
- .2 Do tests in accordance with ASTM F2164.
- .3 Definitions:
 - .1 Leakage is defined as the amount of water required to maintain the test pressure in the mains over the duration of the test period.
 4. Pressure test is the process to locate defects in material as workmanship, thereby permitting proper repair.
 - .2 Leakage test is to establish that the section of line tested, including all joints, fittings and other appurtenances will not leak or that leakage is within the limits of the applicable allowance.
- .4 Provide labour, equipment and materials including temporary fused HDPE pipe caps required to perform hydrostatic and leakage tests hereinafter described.
- .5 Notify Engineer at least 1 working day in advance of all proposed tests. Perform tests in presence of Engineer.
- .6 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Engineer.
- .7 Complete HDPE forcemain leakage test prior to the installation of service connections.
- .8 Upon completion of pipe laying and after Engineer Consultant has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed by Engineer.
- .9 Leave valves, joints and fittings exposed.
- .10 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

- .11 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .12 Open valves.
- .13 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.
- .14 Thoroughly examine exposed parts and correct for leakage as necessary.
- .15 For pipe materials other than PVC or HDPE, calculate leakage from formulas in the appropriate sections of AWWA Standards for that type of pipe.
- .16 If the leakage exceeds the allowable, locate and repair leaks and defects. Repeat the test after repairs until leakage does not exceed the allowable. Visible leaks must be repaired even when the leakage is below the allowable limits.
- .17 Pressure testing - high density polyethylene (HDPE) pipe:
 - .1 Pressure test all HDPE pipes, couplings, joints and other appurtenances under a hydrostatic pressure in compliance with ASTM F2164 latest edition:
 - .1 Test pressure shall be 690 kPa (150 psi) at the lowest point in the Raw Water Pump House.
 - .2 Testing with compressed air is strictly forbidden.
 - .3 Begin test after completion of backfilling and at least 7-days after the last concrete bearing pad has been cast.
 - .4 Expose all mechanical joints for visual inspection during testing.
 - .2 Supply and install temporary fused HDPE pipe caps at the end of new pipe to pressure test new pipe.
 - .3 The test shall consist of two parts:
 - .1 Initial expansion phase:
 - .1 Control rate of filling of pipes to a velocity of less than 0.45 m/sec (1.5 ft/sec).
 - .2 Allow the test section and the water to equalize to a common temperature.
 - .3 After the initial pressurization of the pipe add sufficient make-up water at hourly intervals to return the pipe to the original test pressure.
 - .4 Repeat pressurization a maximum of three times after the original pressurization of the pipe.
 - .2 Test period:
 - .1 After completion of the expansion phase (3-hours after initial pressurization) reduce the maximum test pressure by 69.0 kPa (10 psi).
 - .2 Monitor the test pressure for 1-hour.
 - .3 If no visible leakage is observed, and the test phase remains steady (within 5% of the test phase pressure) for the 1-hour interval, a passing test is indicated.

- .4 If the test does not pass, the system should be de-pressurized, faults or leaks repaired and re-tested. The test section will need to be relaxed for a minimum of 8-hours before being re-pressurized.
- .18 Leak test (connection to existing pipes only):
 - .1 After pressure testing has passed and been accepted by the Engineer, remove and dispose of temporary HDPE force main caps in a manner approved by the Supplier.
 - .2 Couple new HDPE force main with existing HDPE force main with the specified restrained flexible couplings after the HDPE pipe pressure test has passed and been accepted by the Engineer.
 - .3 Pressurize force main to operating pressure for 3-hours.
 - .4 After the 3-hour initial pressurization phase has been completed, monitor the restrained flexible coupling joint for 1-hour.
 - .5 If no visible leakage is observed for the 1-hour interval, a passing test is indicated.
 - .6 If the test does not pass, the system should be de-pressurized, faults or leaks repaired and re-tested. The test section will need to be relaxed for a minimum of 8-hours before being re-pressurized.

3.11 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Engineer.

3.12 CLEANING

- .1 Cleaning: clean in accordance with Division 01.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section of the specifications refers to the installation of equipment, piping, fittings, valves and all piping specialties and supporting devices provided under this contract within the building confines. Also included are the equipment, valve and commodity identification legends for all piping systems to be installed within the building.
- .2 Control valves and other in-line equipment and instruments, specified in Division 26 - Electrical, to be installed under this Section.

1.2 REFERENCE STANDARDS

- .1 Conform to the following reference standards:
 - .1 ANSI A13.1, Scheme for the Identification of Piping Systems.
 - .2 ANSI B1.20.1, Pipe Threads, General Purpose.
 - .3 ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
 - .4 ANSI B16.3, Malleable Iron Threaded Fittings Class 150 and 300.
 - .5 ANSI B16.5, Pipe Flanges and Flanged Fittings.
 - .6 ANSI B16.9, Factory-Made Wrought Steel Butt Welding Fittings.
 - .7 ANSI B16.11, Forged Steel Fittings, Socket Welding and Threaded.
 - .8 ANSI B16.12, Cast Iron Threaded Drainage Fittings.
 - .9 ANSI B16.15, Pipe Flanges and Flanged Fittings, Classes 150 and 300.
 - .10 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .11 ANSI B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .12 ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
 - .13 ANSI B31.1, Power Piping.
 - .14 ANSI B31.3, Chemical Plant and Petroleum Refinery Piping.
 - .15 ANSI B31.9, Building Services Piping.
 - .16 ANSI B32, Solder Metal.
 - .17 ANSI B36.10M, Welded and Seamless Wrought Steel Pipe.
 - .18 ANSI B36.19M, Stainless Steel Pipe.
 - .19 ASME Section IX, Boiler and Pressure Vessel Code; Welding and Brazing Requirements.
 - .20 ASTM A47, Malleable Iron Castings.
 - .21 ASTM A53, Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
 - .22 ASTM A105/A105M, Forgings, Carbon Steel, for Piping Components.
 - .23 ASTM A126, Grey-Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .24 ASTM A135, Electric-Resistance-Welded Steel Pipe.
 - .25 ASTM A139, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over).

- .26 ASTM A167, Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate.
- .27 ASTM A181/181M, Forgings, Carbon Steel, for General Purpose Piping.
- .28 ASTM A197, Cupola Malleable Iron.
- .29 ASTM A269, Seamless and Welded Austenitic Stainless-Steel Tubing for General Service.
- .30 ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes.
- .31 ASTM A307, Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
- .32 ASTM A312/312M, Seamless and Welded Austenitic Stainless-Steel Pipe.
- .33 ASTM A320/320M, Alloy Steel Bolting Materials for Low-Temperature Service.
- .34 ASTM A403/A403M, Wrought Austenitic Stainless-Steel Piping Fittings.
- .35 ASTM A480/A480M, General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .36 ASTM A536, Ductile Iron Castings.
- .37 ASTM A563, Carbon and Alloy Steel Nuts.
- .38 ASTM A570/A570M, Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
- .39 ASTM A774/A774M, As-Welded Wrought Austenitic Stainless-Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
- .40 ASTM A778, Welded, Unannealed Austenitic Stainless-Steel Tubular Products.
- .41 ASTM B88, Seamless Copper Water Tube.
- .42 ASTM C564, Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .43 ASTM D638, Test Method for Tensile Properties of Plastics.
- .44 ASTM D792, Test Method for Specific Gravity and Density of Plastics by Displacement.
- .45 ASTM D1248, Polyethylene Plastics Moulding and Extrusion Materials.
- .46 ASTM D1457, PTFE Moulding and Extrusion Materials.
- .47 ASTM D1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- .48 ASTM D1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- .49 ASTM D2241, Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
- .50 ASTM D2466, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- .51 ASTM D2467, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- .52 ASTM D2513, Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
- .53 ASTM D2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- .54 ASTM D2665, Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- .55 ASTM D2996, Filament-Wound Reinforced Thermosetting Resin Pipe.
- .56 ASTM D4174, Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems.
- .57 ASTM F441, Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

- .58 ASTM F894, Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.
- .59 AWWA C200, Steel Water Pipe, 6" (150 mm) and Larger.
- .60 AWWA C203, Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
- .61 AWWA C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 in (100 mm) through 144" (3600 mm).
- .62 AWWA C206, Field Welding of Steel Water Pipe.
- .63 AWWA C207, Steel Pipe Flanges for Waterworks Services - Sizes 4" (100 mm) through 144" (3600 mm).
- .64 AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings.
- .65 AWWA C209, Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines.
- .66 AWWA C210, Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe.
- .67 AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
- .68 AWWA C220, Stainless-Steel Pipe, ½" (13 mm) and Larger.
- .69 AWWA C218, Coating the Exterior of Aboveground Steel Water Pipelines and Fittings.
- .70 AWWA C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
- .71 AWWA C221, Fabricated Steel Mechanical Slip-Type Expansion Joints.
- .72 AWWA C600, Installation of Ductile-Iron Water Mains and their Appurtenances.
- .73 AWWA C606, Grooved and Shouldered Joints.
- .74 AWWA C651, Disinfecting Water Mains.
- .75 AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, Sizes 4" (100 mm) through 12" (300 mm).
- .76 AWWA M11, Steel Pipe - A Guide for Design and Installation.
- .77 CGA, Canadian Gas Association Standards.
- .78 CPC, Canadian Plumbing Code.
- .79 CSA B64, Series CSA Standards on Vacuum Breakers and Backflow Preventers.
- .80 CSA CAN3-Z299.3, Quality Verification Program Requirements.
- .81 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .82 EJMA STDS, Standards of Expansion Joint Manufacturers' Association, Edition No. 6.
- .83 Fluid Sealing Association Technical Handbook, Rubber Expansion Joint Division.
- .84 MSS SP25, Standard Marking System for Valves, Fittings, Flanges and Unions.
- .85 MSS SP43, Wrought Stainless Steel Butt Welding Fittings.
- .86 SSPC-P3, Canadian Government Standards Board.
- .87 SSPC-SP6, Canadian Government Standards Board.
- .88 SSPC-SP10, Canadian Government Standards Board.

1.3 OPERATING AND MAINTENANCE DATA

- .1 Provide maintenance data for incorporation into the manual specified in Division 01.

1.4 SUBMITTALS FOR REVIEW

- .1 Provide as specified in Division 01.
- .2 Submit documents listing pipe, fittings, flexible connectors, linings, coatings and valving to be used for each pipe system.
- .3 Manufacturer's affidavit of compliance with specified AWWA standards for valves, pipe, fittings, linings and coatings.
- .4 Grooved joint couplings and fittings are to be shown on Drawings and product submittals and specifically identified with the applicable style or series designation.
- .5 Design, select, locate and provide piping supports, pipe guides, seismic bracing, expansion joints and anchors required for final piping layout. Typical details and acceptable attachments shown on the drawings are provided only for general guidance.
- .6 Provide the necessary submittals and ensure the proper registration of piping systems and system components as required by the regulatory authorities having jurisdiction.

1.5 SUBMITTALS FOR INFORMATION ONLY

- .1 Submit copies of all original submittals and all related correspondence made as part of the regulatory submissions required by regulatory authorities.
- .2 Product samples: Where specified or when directed by the Engineer, provide mill test results or product samples.
- .3 Provide hanger, expansion joint, guide, anchor, support and seismic restraint system design details including locations, load information, design calculations and illustrative drawings, stamped and signed by a Professional Engineer registered in the Province of Saskatchewan.
- .4 For expansion joints submit Manufacturer's catalogue data, shop drawings and assembly drawings confirming general arrangement, dimensions, tolerances, materials of construction, weights and installation details. Submit calculations to substantiate expansion joint selection and amount of precompression, stamped and signed by a professional Engineer registered in the Province of Saskatchewan.
- .5 Submit current and complete documentation of the Welder's qualifications prior to the commencement of welding.

1.6 START-UP, COMMISSIONING AND TRAINING

- .1 Provide as specified in Division 01.

1.7 PIPE MATERIALS - GENERAL

- .1 All pipe materials to be new, free from defects and conforming to applicable reference standards.
- .2 All materials, linings and coatings in contact with water to be NSF approved for potable water.
- .3 All grooved joint couplings, fittings, valves and specialties are to be the products of a single manufacturer. Grooving tools are to be of the same manufacturer as the grooved components.
- .4 All castings used for coupling housings, fittings, valve bodies, etc., are to be date stamped for quality assurance and traceability.
- .5 Where any standard referenced has been superseded prior to bidding, the Contractor is to comply with the current standard.

1.8 PIPE SIZES

- .1 Where the pipe size is not specified, provide pipe with the sizes required by the Plumbing Code. Small piping not described by the Plumbing Code or otherwise specified herein is to be 12 mm nominal diameter.

1.9 JOINTS - GENERAL

- .1 Connect piping using joints not readily disassembled only where shown and where not otherwise specified. Provide joints which may be disassembled at the minimum, within 1.0 m of any connection to equipment, on both sides of structural penetrations, within 0.6 m of all threaded end valves, and at the spacing specified in the detailed piping specification sheets.
- .2 For steel piping less than 80 mm in diameter, butt-weld or use threaded couplings. Use unions where disassembly is required:
 - .1 Unions are not required in installations using grooved mechanical joint couplings (These couplings serve as unions and disconnect points).
- .3 For steel piping equal to or greater than 80 mm in diameter, where not specified or shown otherwise, butt-weld according to ASME Boiler and Pressure Vessel Code or furnish slip-on flanges, conforming to ANSI B16.5, Class 150. Unless indicated otherwise on the drawings or detail specifications, where disassembly is required, use flanges.
- .4 For stainless steel tubing use stainless steel compression fittings.
- .5 For schedule rated stainless steel pipe smaller than 80 mm in diameter, socket-weld pipe. Where disassembly is required, use threaded unions.
- .6 For thin wall or schedule rated stainless steel pipe equal to or greater than 80 mm in diameter, butt-weld pipe unless otherwise shown or specified.
- .7 For copper or brass piping, use soldered couplings. Where disassembly is required, use compression unions.

- .8 For ductile iron piping, where not shown or otherwise specified, and for other piping where specified or shown, use grooved joints in accordance with AWWA C606.
- .9 Where not shown or otherwise specified, use solvent weld joints for PVC and FRP piping. Provide flanges or unions where disassembly is required.

Part 2 Products

2.1 FLANGES

- .1 Unless otherwise noted, make 50 mm diameter to 600 mm diameter flanges on steel and stainless-steel pipe Class 150, conforming to ANSI B16.5. Companion flanges for connection to cast iron or ductile iron equipment flanges shall be refaced to be flush with the companion flange.
- .2 General requirements for flanges are as follows:
 - .1 Compatible flanges for mating to equipment or valves.
 - .2 Provide flat-faced flanges on each side of butterfly valves.
 - .3 For steel piping, provide weld neck flanges on both sides of wafer or lug body valves.
- .3 Do not use slip-on flanges that are attached to a pipe by means of set screws and gaskets.

2.2 SOLDERED COUPLINGS

- .1 Soldered couplings for copper pipe conform to ANSI B16.26. Solder to be lead free conforming to ASTM B32 and the Plumbing Code.

2.3 THREADED COUPLINGS

- .1 Make screwed joints using American Standard threads to ANSI B1.20.1.
- .2 Use Teflon tape as thread lubricant for threaded joints.
- .3 Conform to ASTM A182 or ASTM A276, Class 150, for threaded connections to stainless steel pipe, threadolet to be shop welded to the pipe at the locations specified.
- .4 Provide threaded-end to flanged-end adaptors where required to connect to flanges.

2.4 COMPRESSION COUPLINGS

- .1 Furnish compression couplings for stainless steel tubing of the same material as the pipe, capable of withstanding the maximum pressure to which the pipe is subjected.
- .2 Furnish compression couplings for copper and brass tubing of copper, suitable for the maximum pressure of the pipe, conforming to ANSI B16.26.

2.5 GROOVED JOINT COUPLINGS

- .1 Fabricate grooved joint couplings of ductile iron to ASTM A536, and in accordance with AWWA C606. Provide cut grooves in pipe and fittings in accordance with AWWA C606. Rolled grooves and roll-groove type joints are not acceptable on cast ductile iron pipe.
- .2 Use flexible style couplings for all buried service pipe, all pipe greater than 300 mm in diameter, for pipe less than 300 mm in diameter in rack mounted piping assemblies and for grooved joints adjacent to pump or blower suction and discharge where grooved joints are used for noise and vibration control.
 - .1 Acceptable products are:
 - .1 Steel pipe: Victaulic Style 07 Zero-Flex or Style 107N Quick-Vic with offsetting angle-pattern bolt pads for sizes through 300 mm or Style W07 AGS for sizes 350 mm through 600 mm; or
 - .2 Stainless steel pipe: Victaulic Style 877N or Style 177N Quick-Vic with galvanized finish for sizes to 300 mm. and Style W77 AGS with galvanized finish for sizes 350 mm through 600 mm.
- .3 Use rigid style couplings in all other applications.
 - .1 Acceptable products are:
 - .1 Steel pipe: Victaulic Style 07 Zero-Flex or Style 107N Quick-Vic with offsetting angle-pattern bolt pads for sizes through 300 mm or Style W07 AGS for sizes 350 mm through 600 mm; or
 - .2 Stainless Steel pipe: Victaulic Style 889 with galvanized finish for sizes through 300 mm or Style W489 AGS with galvanized finish for sizes 350 mm through 600 mm with galvanized finish.
- .4 Ductile Iron Pipe: provide pipe with rigid cut grooves for exposed services, and flexible cut grooves for buried services.
 - .1 Acceptable coupling products are:
 - .1 Victaulic Style 31 with FlushSeal® gasket;
 - .2 For transition between ductile iron pipe sizes and steel pipe sizes;
 - .3 Victaulic Style 307; or
 - .4 Approved equal.
- .5 Where grooved joint piping systems connect to equipment or to flanged valves, meters or other sensing devices; use grooved joint flanges or flange adapters.
 - .1 Acceptable products are:
 - .1 Victaulic Style 741 or W741 (steel pipe) and Style 341 (ductile iron pipe).
- .6 Steel pipe to PVC pipe 300 mm diameter smaller.
- .7 Where the Contractor chooses to use grooved joint flanges rather than the indicated adapters, piping modifications required to suit this change are the responsibility of the Contractor. Make full allowance for piping disassembly and access to the face of equipment.

2.6 FLANGE COMPRESSION COUPLING ADAPTER

- .1 Approved products:
 - .1 Robar model 7906; or
 - .2 Romac style FC 400.

2.7 FLEXIBLE COUPLINGS

- .1 Flexible Couplings - Type I:
 - .1 Flexible sleeve type couplings: cylindrical centre ring, two follower rings, two resilient gaskets and connecting bolts. Acceptable products are:
 - .1 Dresser Style 38;
 - .2 Ford Meter Box FC1;
 - .3 Robar 1408;
 - .4 Rockwell Type 411;
 - .5 Viking Johnson Quick-Fit; or
 - .6 Victaulic 'Depend-O-Lok' ExE or FxE.
 - .2 Transition flexible sleeve type couplings: Cylindrical centre ring, two follower rings two resilient gaskets and connecting bolts. Acceptable products are:
 - .1 Dresser Style 62; or
 - .2 Robar 1408.
 - .3 Centre ring: steel, shop coated for corrosion protection.
 - .4 Gaskets: fabricated of material suitable to the service conditions.
 - .5 For submerged, buried or below structure applications, use stainless steel bolts, nuts and washers.
 - .6 Provide the necessary amount and appropriate size of restraining rods and gussets as recommended by the Manufacturer.
 - .7 Type 1 - Restrained; use a flexible sleeve-type coupling with restraining rods, and gussets welded to the pipe to AWWA M11. Provide sufficient restraint to resist pressure equal to twice the system test pressure.
- .2 Flexible Couplings - Type II:
 - .1 Flexible pipe couplings: progressive sealing, capable of 2° angular deflection in all directions, leak proof.
 - .2 Acceptable manufacturers:
 - .1 Straub; or
 - .2 Victaulic Series 89 or 489 (rigid) or 77S (flexible) for grooved joint stainless-steel pipe and fittings.
 - .3 Casing: 304 or 316 stainless steel.
 - .4 Lockparts: Steel, shop coated for corrosion protection. Use 304 stainless steel for buried or submerged services.
 - .5 Gaskets: fabricated of material suitable to the service conditions.
- .3 Unless specifically shown otherwise, use Type I flexible couplings where a flexible coupling is shown or required.

2.8 IRON PIPE JOINTS

- .1 Unless shown or specified otherwise, for ductile iron pipe within buildings or aboveground, refer to groove joint couplings.
- .2 Push-on joints: rubber ring compression, bell and spigot type. Assemble in accordance with AWWA C600 and Manufacturer's recommendations. Do not use on fittings or other appurtenances.
- .3 Bolted mechanical joints: Comply with ANSI A21.10 and ANSI 21.11.
- .4 Where restrained mechanical joints are shown or specified, ensure joints can be disassembled after installation. Do not use internal restraints. Factory apply retainer weldments. Do not use joints, which employ set screws, retainer glands, or concrete thrust anchors. Acceptable products are: Lok-Ring, or TR Flex.
- .5 For cast iron drainpipe inside structures or concrete encased, use gasket and retaining clamp type mechanical joint conforming to CSA B70.

2.9 POLYETHYLENE (HDPE) PIPE JOINTS

- .1 Refer to pipe Manufacturer's specifications for product information and installation instruction.
- .2 Provide bell and spigot type joints conforming to ASTM D3212.
- .3 Provide pipe, pipe support and restraints to withstand stresses induced by joint design.
- .4 Provide pipe, pipe supports and restraints to withstand the stresses incurred during placement of concrete surround.

2.10 SLIDING JOINTS - LIQUID SERVICE

- .1 Provide single end type sliding expansion joints able to allow longitudinal movement and radial stresses while maintaining pipe alignment. Provide through rods where necessary to maintain alignment.
- .2 Limit longitudinal separation of the two pipe sections to 50% of the Manufacturer's recommended maximum by a restraining flange affixed to the slip pipe with the bolts extending through this flange.
- .3 Use packing material suitable for the service conditions.
- .4 Acceptable products are:
 - .1 Dresser Style 63;
 - .2 Ford Meter Box FEJ;
 - .3 Robar 8808-1; or
 - .4 Rockwell 611.

2.11 FLEXIBLE HOSE CONNECTORS

- .1 Where other types of flexible expansion joints are not shown or specified, provide flexible hose connectors within 2 m pipe length of rotating equipment suction, discharge and ancillary service connection. Do not provide flexible connectors on sump pump connection piping.
- .2 Provide flexible hose connectors with live lengths suitable for a line pressure equal to the test pressure of the pipe and for 12.5 mm lateral movement each side of the pipe centreline.
- .3 Provide one union for pipe diameters ≤ 65 mm or floating flange for pipe diameter > 65 mm, per flexible connector as appropriate to minimize the possibility of torque damage during installation.
- .4 Provide flexible hose connectors capable of minimum of 10,000 cycles at the Manufacturer's published minimum intermittent centreline bend radius and maximum working pressure.
- .5 The design standard for flexible hose connectors on piping systems up to and including 50 mm diameter is Senior Flexonics Type 461 helically corrugated hose connectors.
- .6 Acceptable manufacturers for flexible hose connectors on piping systems up to and including 50 mm diameter are:
 - .1 American BOA;
 - .2 Flex-Weld; or
 - .3 Senior Flexonics.
- .7 The design standard for flexible hose connectors on piping systems larger than 50 mm diameter is Senior Flexonics Type 401 M corrugated flexible metal hose connectors.
- .8 Acceptable manufacturers for flexible connectors on piping systems larger than 50 mm diameter are:
 - .1 American BOA;
 - .2 Flex-Weld; or
 - .3 Senior Flexonics.

2.12 FITTINGS

- .1 For steel pipelines 80 mm in diameter or greater, fittings to conform to ANSI B16.9, ANSI B16.11 or ANSI B16.5. Provide fittings with a wall thickness equal to or greater than the pipe. In steel pipelines less than 80 mm in diameter provide threaded malleable iron fittings, conforming to ANSI B16.3.
- .2 Provide long radius steel grooved-joint fittings conforming to ANSI B16.9 in steel grooved-joint pipeline systems. Grooved joint adapters may be welded to fitting ends; dimension and cut the groove of the adapter in accordance with the coupling Manufacturer's recommendations; materials and inside diameter to be the same as the pipe; grind the interior weld smooth and meet the lining Manufacturer's recommendations.

- .3 For steel grooved-joint pipe of diameters of 150 mm and less, the Contractor may provide ductile iron grooved-joint fittings, which have an outside diameter equal to the steel pipe diameter. Provide ductile iron to ASTM A536, dimensioned to 1.5 diameter radius bends and cut grooving dimensions to AWWA C606 IPS dimensions. The lining and coating of the ductile iron fittings must equal the lining and coating of the steel pipeline system.
- .4 Standard radius elbows to dimensions of ANSI B16.5 may be provided on clean water grooved-joint piping systems only.
- .5 class as the pipe, conforming to ASTM A403 and ANSI B16.11. Provide socket welding fittings in stainless steel pipelines less than 80 mm to Cl. 3000, same material as the pipe, and ANSI B16.11. Fabricate fittings in stainless steel pipelines equal to or greater than 80 mm in diameter using similar materials and classes as the pipe and conform to ASTM A774.
- .6 Provide fittings in flanged ductile iron pipelines that conform to ANSI B16.1 and in grooved end or mechanical joint ductile iron pipelines to AWWA C110.
- .7 Provide ductile iron fittings in PVC pipelines that conform to AWWA C110 or provide PVC to CSA B137.3, of the same material and class as the pipe.
- .8 Provide fittings in FRP pipelines of the same material and class as the pipe.
- .9 Provide copper fittings in copper pipelines conforming to ANSI B16.26.
- .10 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise.
- .11 Provide concentric reducers in vertical lines unless indicated otherwise.
- .12 Provide long radius elbows unless otherwise shown. Provide smooth flow carbon or stainless-steel elbows 350 mm and less, to ANSI B16.9. Provide mitred elbows greater than 350 mm, to AWWA C208 unless otherwise shown or specified. Use 3-piece construction, unless otherwise shown or specified.
- .13 Provide fittings in concrete cylinder pipe fabricated from metal plate, cement lined and coated, and in accordance with AWWA C301. Dimensions to AWWA C208.
- .14 Provide PVC fitting in PVC pipe in accordance with ASTM D2467.

2.13 GASKETS

- .1 For flat faced flanges, use full-face gaskets. For raised-face flanges, use ring type gaskets. Conform to ASTM B16.21.
- .2 Use gasket materials for flanged connections suitable for the temperature, pressure, and corrosivity of the fluid conveyed in the pipeline. Refer to detailed pipe specifications for recommended gasket material. Material designations used in the detailed pipe specification sheets are as follows:
 - .1 EPDM: ethylene-propylene-diene-terpolymer 70 durometer.

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- .2 Bl. Neoprene: neoprene (black) 70 durometer.
- .3 Nitrile: nitrile (Buna N).
- .4 SBR: Styrene-butadiene (red).
- .5 Natural rubber: natural rubber.
- .6 Compressed synthetic fibres (Kevlar): ASTM F104 (F712400), and neoprene binder: 1.7 MPa (ASTM F152), 0.2 mL/h Leakage Fuel A (ASTM F37).
- .7 Compressed synthetic fibres (Kevlar): ASTM F104 (F712400) and SBR binder: 1.7 MPa (ASTM F152), 0.1 mL/h Leakage Fuel A (ASTM F37).
- .8 Gylon - Type 1: Garlock Style 3500, 1.35 MPa (ASTM F152), 0.22 mL/h Leakage Fuel A (ASTM F37).
- .9 Gylon - Type 2: Garlock Style 3510, 1.35 MPa (ASTM F152), 0.04 mL/h Leakage Fuel A (ASTM F37).
- .10 CPE - Chlorinated Polyethylene.
- .3 Unless otherwise specified, minimum Gasket Material Thickness for full face gaskets:
 - .1 80 mm to 250 mm pipe diameter; 1.6 mm thick.
 - .2 Greater than 250 mm pipe diameter; 3.2 mm thick.
- .4 Unless otherwise specified, minimum gasket material thickness for raised face ring gaskets:
 - .1 80 mm to 100 mm pipe diameter; 1.6 mm thick.
 - .2 Greater than 100 mm pipe diameter; 3.2 mm thick.
- .5 Grooved joint gasket materials to be as recommended by the Manufacturer for the service conditions indicated. Unless otherwise specified, provide flush seal type gaskets for all grooved joint systems. Acceptable products: Gustin-Bacon Rigigrip, Victaulic Flush-Seal:
 - .1 Lubricants: Lubricate gaskets in accordance with the Manufacturer's recommendations with lubricant supplied by the coupling Manufacturer that is suitable for the gasket elastomer and system media.

2.14 BOLTS AND NUTS

- .1 Provide hex head bolts and nuts. Threads to be ANSI B1.1, standard coarse thread series.
- .2 For general interior service, use zinc coated bolts and nuts conforming to ASTM A307, Gr. A; zinc coated nuts conforming to ASTM A563, Gr. A.
- .3 Provide stainless steel bolts, nuts and washers for stainless steel pipe, submerged, buried and concrete encased service; bolts conforming to ASTM A193, Gr. B8, C1.1; nuts conforming to ASTM A194, Gr.8.
- .4 Provide hot dip galvanized bolts, nuts and washers for use with hot dip galvanized Van Stone flange back-up rings and lap-joint flange back-up rings.
- .5 Provide hex nuts equal to or less than 25 mm. Greater than 25 mm, provide heavy hex.

2.15 DISSIMILAR METAL CONNECTIONS

- .1 Where dissimilar metals are to be connected, furnish dielectric fittings and/or isolating flanges.

2.16 GALVANIZING

- .1 Where piping is to be galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m².

2.17 INSTRUMENT AIR CONNECTIONS

- .1 Provide instrument air connections to each instrument with a run of 12 mm stainless steel tubing from the nearest instrument air header to within close proximity of each device requiring instrument air.
- .2 Terminate each tubing run with a 12 mm ball valve (stainless steel) within 1500 mm horizontal distance of the device and 1500 mm off the floor. Group multiple valves neatly together with a common orientation.
- .3 Provide a vertical riser connection at the header to avoid condensate entrainment. From the top of the riser, slope the tubing generally down to the device.

2.18 STRAINERS

- .1 Air and gas strainers:
 - .1 Provide strainers with Y-pattern, cast iron body, with 40 mesh Monel screens packed with Everdur wool. For copper piping, provide bronze bodies.
 - .2 Fit air line strainers with a brass blowoff cock.
 - .3 Acceptable Manufacturers are:
 - .1 Armstrong; or
 - .2 Mueller.
- .2 Grooved end strainers for water systems:
 - .1 Provide strainers with:
 - .1 Y-pattern ductile iron body with access coupling and cap and stainless-steel frame and mesh basket.
 - .2 T-pattern carbon steel body with T-bolt hinged closure and stainless-steel frame and mesh basket.
 - .2 Cap/closure tapped for blowoff connection.
 - .3 Approved products:
 - .1 Victaulic Series 732 (Y-pattern) or W730 (T-pattern).
- .3 Steam and water strainers:
 - .1 Provide steam and water strainers with Y-pattern unless otherwise specified.
 - .2 Provide carbon steel body for steam strainers, cast iron body for water strainers, and bronze bodies for copper piping systems.

- .3 Provide 304 stainless steel screens and tapped and plugged blowoff connections. Screen perforations shall be 0.5 mm for steam service and 1.15 mm for water service.
- .4 Acceptable Manufacturers are:
 - .1 Armstrong; or
 - .2 Mueller.
- .4 Sodium hypochlorite strainers:
 - .1 Provide Y-pattern sodium hypochlorite strainers with a PVC body.
 - .2 Provide PVC Filter Screen with 0.8 mm screen perforations.
 - .3 Provide tapped and plugged blowoff connections.

2.19 QUICK DISCONNECTS

- .1 Provide quick disconnects which are not disconnectable under pressure. Unless otherwise shown or specified, provide products listed below.
- .2 For air service, acceptable products are:
 - .1 Dixon Air King; or
 - .2 Tomco, 12 mm diameter. Tomco, THK.
- .3 For water service, sizes as shown. Acceptable products are:
 - .1 For 25 mm or less diameter hose, 2-lug, malleable iron, female NPT: Dixon Air King.
 - .2 For 38 mm and 50 mm diameter hose, 4-lug, malleable iron, female NPT: New Line Dixon Air King.
 - .3 For 80 mm and 100 mm diameter or greater; quick-acting, dual clip: Rite-pro, Dixon.

2.20 FLUSHING CONNECTIONS

- .1 Provide flushing connections on all piping for the conveyance of sludge, scum, grit or other liquid containing solids greater than 0.5%. Locate flushing connections adjacent to all isolation valves, on dead end branches, at tees and 90° elbows, and at intermediate locations which limit the distance between flushing connections to less than 30 m. Show flushing connections on piping submittals.

2.21 PURGE CONNECTIONS

- .1 Provide purge connections on all gas lines. Locate adjacent to both sides of all isolation valves and spectacle flanges, and at any other locations shown in the drawings. Purge points shall be a minimum of 20 mm NPS pipe, fitted with a shut-off valve, which shall be capped.

2.22 MECHANICAL BRANCH CONNECTIONS

- .1 Provide mechanical branch connections as required for flushing connections and pipe tappings. Provide branch connection recommended by the Manufacturer for the service and pipe installed. Acceptable products are:
 - .1 Gruvlock Clamp T;
 - .2 Ford Service Saddles (F/FS); or
 - .3 Victaulic Mechanical T.

2.23 ACCESS DOORS

- .1 Provide access doors to concealed mechanical equipment for operating, inspecting and servicing.
- .2 Flush mounted, 600 mm x 600 mm size for body entry and 300 mm x 300 mm for hand entry, unless noted otherwise.
- .3 Doors to open 90°, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.
- .4 Finishes:
 - .1 General: prime coated steel.
 - .2 Special areas such as tiled or marble surfaces: stainless steel.
- .5 Acceptable product: Buensod, Le Hage, Zurn.

2.24 DIELECTRIC COUPLINGS

- .1 Wherever pipes of dissimilar metals are joined.
- .2 Insulating unions for pipe sizes 50 mm and smaller and insulating flanges for pipe sizes larger than 50 mm.

2.25 DRAIN VALVES

- .1 Locate at all low points and section isolating valves unless otherwise specified.
- .2 Minimum 20 mm size unless otherwise specified: straight pattern bronze with hose end male thread and complete with cap and chain.

2.26 VIBRATION ISOLATION

- .1 Elastomeric pads:
 - .1 Type P1: neoprene waffle or ribbed, 9 mm minimum thickness, 50 durometer, maximum loading 350 kPa.
 - .2 Type P2: rubber waffle or ribbed, 9 mm minimum thickness, 30 durometer natural rubber, maximum loading 415 kPa.

- .3 Type P3: neoprene-steel-neoprene, 9 mm minimum thick neoprene bonded to 1.71 mm steel plate, 50 durometer neoprene, waffle or ribbed, holes sleeved with isolation washers.
- .4 Type P4: rubber-steel-rubber, 9 mm thick rubber bonded to 1.71 mm steel plate, 30 durometer natural rubber, waffle or ribbed, holes sleeved with isolation washers.
- .5 Acceptable products are:
 - .1 Korfund;
 - .2 Vibron; or
 - .3 Vibro-Acoustics.
- .2 Elastomeric mounts:
 - .1 Type M1: colour coded, neoprene-in-shear, maximum durometer of 60, threaded insert and 2 bolt-down holes, ribbed top and bottom surfaces.
 - .2 Acceptable product:
 - .1 Korfund;
 - .2 Vibron; or
 - .3 Vibro-Acoustic.
- .3 Springs mounts:
 - .1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.
 - .2 Cadmium plate for outdoor installations.
 - .3 Colour code springs.
 - .4 Zinc or cadmium coated hardware, housings coated with rust resistant paint.
 - .5 Type M2: stable open spring, support on bonded 6 mm thick ribbed neoprene or rubber friction and acoustic pad.
 - .6 Type M3: stable open spring, 6 mm minimum thickness ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate, internal adjustment, equipment bolting not necessary.
 - .7 Type M4: Restrained stable open spring, supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, built-in resilient limit stops, removable spacer plates.
 - .8 Type M5: enclosed spring mounts with snubbers, for isolation up to 23 kg maximum.
 - .9 Acceptable product:
 - .1 Korfund;
 - .2 Masdom VM;
 - .3 Vibron; or
 - .4 Vibro-Acoustics.

- .4 Spring hangers:
 - .1 Colour coded springs, rust resistant, painted, box type hangers. Swivel arrangement to permit hanger box or rod to move through a 20° arc without metal-to-metal contact.
 - .2 Type H1: neoprene, in shear.
 - .3 Type H2: stable spring, elastomeric washer.
 - .4 Type H3: stable spring, elastomeric element.
 - .5 Type H4: stable spring, elastomeric element with lockout plate and indicator.
 - .6 Acceptable product:
 - .1 Korfund;
 - .2 Masdom VM;
 - .3 Vibron; or
 - .4 Vibro-Acoustic.
- .5 Acoustic barriers for anchors and guides:
 - .1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy-duty duck and neoprene isolation material.
 - .1 Acceptable product:
 - .1 Masdom VM;
 - .2 Vibron; or
 - .3 Vibro-Acoustics.
- .6 Horizontal thrust restraint:
 - .1 Spring and elastomeric element housed in box frame, assembly complete with rods and angle brackets for equipment attachment, provision for adjustment to limit maximum start and stop movement to 9 mm.
 - .2 Restraints arranged symmetrically on either side of unit and attached at centerline of thrust.
 - .3 Acceptable product:
 - .1 Korfund;
 - .2 Masdom VM;
 - .3 Vibron; or
 - .4 Vibro-Acoustic.
- .7 Structural bases:
 - .1 Type B1 - prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension; split for field welding on sizes over 2400 mm on smallest dimension and reinforced for drive and drive alignment, without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

- .2 Type B2 - steel rail base: structural steel, positioned for drive and driven alignment, without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.
- .3 Bases to clear housekeeping pads by 25 mm minimum.
- .4 Acceptable product:
 - .1 Korfund;
 - .2 Masdom VM;
 - .3 Vibron; or
 - .4 Vibro-Acoustic.
- .8 Inertia base forms:
 - .1 Type B3 - Full depth perimeter structural or formed channel frames: welded in place, reinforcing rods running in both directions; spring mounted units carried by gusseted height saving brackets welded to frame; and clear housing pads by 50 mm minimum.
 - .2 Bases: "T" shaped, where applicable, to provide support for pump elbows.
 - .3 Acceptable product:
 - .1 Korfund;
 - .2 Masdom VM;
 - .3 Vibron; or
 - .4 Vibro-Acoustic.

2.27 DRIVES, GUARDS AND LUBRICATION ACCESSORIES

- .1 Select variable and adjustable pitch sheaves unless otherwise specified.
- .2 Provide motor driven equipment using three or more belts with fixed sheaves.
- .3 Fit reinforced belts in sheave matched to drive. Multiple belts on unit to be matched set.
- .4 Use cast iron or steel sheaves secured to shafts with removable keys.
- .5 Standard adjustable pitch drive sheaves having +10% range to be used on motors from 0.25 kW to 7.5 kW. Use mid-position of range for specified RPM.
- .6 For drives larger than 7.5 kW, sheaves to be split tapered bushing and keyway having a fixed pitch, unless specifically required for item concerned. Provide sheave of correct size for balancing.
- .7 Minimum drive rating to be 1.5 times nameplate rating of motor. Keep overhung loads within Manufacturer's design requirements on prime mover shafts.
- .8 Motor slide rail adjustment plates to allow for centerline adjustment.
- .9 Provide guards for exposed drives.

- .10 Guards for drives to have:
 - .1 Expanded metal screen welded to 25 mm steel angle frame.
 - .2 18 Ga. galvanized sheet metal tops and bottoms.
 - .3 Removable sides for servicing.
 - .4 40 mm diameter holes on both shaft centers for insertion of a tachometer.
- .11 Secure guards to driven machine, foundations or floors with heavy angle supports and anchor bolts.
- .12 Do not short circuit vibration isolators.
- .13 Provide means to permit lubrication, use of speed counters or other maintenance and testing operations, with the guard in place.
- .14 Install belt guards to permit movement of motors for adjusting belt tension.
- .15 For flexible couplings, provide removable "U" shaped guards fabricated from 12 Ga. galvanized steel frame with 18 Ga. expanded mesh face.
- .16 Provide protective screen on both inlet and outlet of exposed fan blades. Screen to be fabricated from 20 mm mesh minimum galvanized expanded metal such that the net free area of openings is not less than 80% of the original opening.
- .17 Provide oil gauges, grease cups, oil cups or grease gun fittings at all points requiring lubrication. Extend all fittings as required to be fully accessible without requiring any disassembly or removal of guards.

Part 3 Execution

3.1 PIPING, VALVES AND EQUIPMENT IDENTIFICATION

- .1 Tagging:
 - .1 Provide each valve and equipment with an identification tag as indicated on P&ID.
 - .2 Tag dimensions: 20 mm high, 75 mm long and 1.5 mm thick c/w hole suitable for #6 stainless steel bead chain.
 - .3 Material: 24 Ga., 316 stainless-steel.
 - .4 Lettering process: laser.
 - .5 Font: Arial, 6 mm (0.25") height.
 - .6 Each equipment item to be identified as indicated on the drawing legend sheets.
 - .7 Affix tags to valve and equipment with stainless steel chains or mechanically fastened.
 - .8 Approved supplier: Pro-Touch Engineering and Signage.
- .2 Pipe commodity identification:
 - .1 Use Brady pipe banding tape to illustrate pipe commodity.

- .2 Maximum spacing: 3.0 m.
- .3 Apply tape in strict accordance with Manufacturer requirements.
- .4 Pipe colors: to Ministry of Environment and Resource Managements.
- .5 Identify contents by background colour marking, pictogram (as necessary), legend, direction of flow by arrows. To CAN/CGSB 24.3 for Building Mechanical systems except where specified otherwise.

3.2 PIPE WELDING

- .1 Steel pipe shop welding to: ANSI B31.3.
- .2 Steel pipe field welding to: ANSI B31.3.
- .3 PVC pipe solvent welding to: Manufacturer recommended procedure.

3.3 PIPING INSTALLATION

- .1 General:
 - .1 Conform to requirements of ANSI B31 code for pressure piping.
 - .2 Install straight, parallel and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes.
 - .3 Install groups of piping parallel to each other, spaced to permit application of insulation, identification and service access on trapeze hangers.
 - .4 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
 - .5 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
 - .6 Install flanged or welded nozzles, branch connections, welding outlets, adapters and taps, true and faced at right angles to the axis of the pipe. Do not extend connection inside of pipe.
 - .7 Make pipe ends round and true, suitable for weld connection.
 - .8 Prepare pipe ends in accordance with ANSI B16.25 for butt welding.
 - .9 Copper pipe and tubing to be free from surface damage. Replace damaged pipe or tubing.
 - .10 Ream ends of pipe and tubes before being made up.
 - .11 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.
 - .12 Use non-corrosive lubricant or Teflon tape applied to male thread only.
 - .13 Groove pipe ends, cut square, seating surface clean and free from indent and score marks.
 - .1 Grooved joints are to be installed in accordance with the Manufacturer's latest published installation instructions.
 - .2 Gaskets are to be of an elastomer grade suitable for the intended service and coupling type.

- .3 Consult with grooved coupling Manufacturer's factory representative regarding on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products.
- .14 Prepare pipe and install stainless steel compression fitting in accordance with Manufacturer's instructions using tools specifically intended for compression fitting type.
- .15 Install dielectric fittings wherever piping of dissimilar metals is joined.
- .16 Install flanges or unions to permit removal of equipment without disturbing piping systems, as required by piping standard.
- .17 Clean ends of pipes or tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.
- .18 Support piping during construction to prevent abnormal stresses on the pipe works.
- .19 Install pipe supports where indicated on the Drawings or as required.
- .20 Install pipe hangers as required.
- .2 Flanges bolting to valves:
 - .1 Do not weld adjacent flanges on butterfly valves when the valve is in place.
 - .2 Remove valve prior to welding.
 - .3 Clean gasket surfaces, flange faces and butt-welding connections.
 - .4 Protect connecting surfaces.
- .3 Bolted connections:
 - .1 Clean pipe ends and gaskets.
 - .2 Lubricate gaskets with soapy water and bolts with thread lubricant.
 - .3 Tighten bolts progressively by crossover method and not in rotation around the joint.
 - .4 Tighten bolts to the torque recommended by the Manufacturer.
 - .5 Use properly sized wrenches for bolt tightening to prevent rounding of nut and bolt heads.
 - .6 Branch connections: branch connections to be in accordance with the following for ANSI 150, 300, 600, 900 and 1500 ratings:

MAIN	20	25	40	50	65	80	100	150	200	250
20	T									
25	RT	T								
40	RT	RT	T							
50	C	TH	RT	T						
65	C	RT	RT	RT	T					
80	C	C	C	RT	*RT	T				
100	C	C	C	*W	*RT	RT	T			
150	C	C	C	*W	*RT	W	RT	T		
200	C	C	C	*W	*W	W	W	RT	T	
250	C	C	C	*W	*W	W	W	RT	RT	T
300	C	C	C	*W	*W	W	W	RT	RT	RT
350	C	C	C	*W	*W	W	W	RT	RT	RT

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400	C	C	C	*W	*W	W	W	RT	RT	RT
450	C	C	C	*W	*W	W	W	W	RT	RT
500	C	C	C	*W	*W	W	W	W	RT	RT
600	C	C	C	*W	*W	W	W	W	W	W

Legend:

T - Straight Tee *C - Coupling*
RT - Reducing Tee *W - Weldolet*
TH - Thredolet

**For Class 150 - A1 line class, including A1A and A1B, but not A1C, piping 65 mm size and under to be screwed connections. The branch connections will, therefore, be TH (thredolet).*

MAIN	300	350	400	450	500	600
300	T					
350	RT	T				
400	RT	RT	T			
450	RT	RT	RT	T		
500	RT	RT	RT	RT	T	
600	RT	RT	RT	RT	RT	T

Legend:

T - Straight Tee *C - Coupling*
RT - Reducing Tee *W - Weldolet*
TH - Thredolet

3.4 VALVES INSTALLATION

- .1 Storage of valves:
 - .1 Store valves in cool and clean location, away from moving vehicles or other objects.
 - .2 Prevent dirt and debris entering the valve internals.
 - .3 Protect the valve seats against painting.
 - .4 Store valves with their handwheels, operator shafts and operators in an upright position.
- .2 Handling valves:
 - .1 Do not place chains, cables and ropes through valve ports or attached to operators or handwheels.
 - .2 Use sling either around valve body or with bolts or rods through the flange holes.
- .3 Installation of valves:
 - .1 Installation of valves to be by qualified personnel and in strict accordance with Manufacturer's instructions.
 - .2 Inspect pipe and remove all foreign debris or objects that may prevent closing of valves prior to the installation of any valves.
 - .3 Install butterfly valves with their operating shafts in the vertical position unless otherwise directed by the Engineer.

3.5 PROTECTION OF OPENINGS

- .1 Protect equipment and system openings from dirt, dust and other foreign materials.
- .2 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances prior to being put into operation.

3.6 EQUIPMENT PIPING CONNECTIONS

- .1 Where equipment connections sizes differ from the pipe size, all associated isolating valves and fittings to be the larger pipe size unless specifically indicated otherwise on the drawings. This also applies to the installation of control valves.

3.7 EQUIPMENT LUBRICATION

- .1 All equipment placed in operation prior to the completion of the contract to be maintained and adequately lubricated in accordance with the Manufacturer's instructions.
- .2 All equipment to be lubricated in accordance with the Manufacturer's instructions prior to acceptance of any system.
- .3 Oil level gauges, grease cups and grease fittings for all machinery bearings, etc., to be provided as recommended by the Manufacturer. Locate oil level gauges for easy viewing.
- .4 All bearings to be flushed out and refilled with new change of oil prior to final acceptance.
- .5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion.

3.8 SLEEVES

- .1 Provide individual metal sleeves for all pipes, tubes or ducts penetrating all walls and floor slabs. Grout tightly in place for full depth of wall or slab.
- .2 Standard sleeves to be 22 Ga. galvanized sheet steel with lock seam joints, unless otherwise specified.
- .3 Use cast iron or steel pipe sleeve with annular fin continuously welded at midpoint:
 - .1 Through foundation walls.
 - .2 Where sleeve extends above finished floor.
- .4 Sizes:
 - .1 Refer to mechanical drawings for details.
 - .2 Provide 6 mm clearance all around, between sleeves and pipe or between sleeve and insulation.
- .5 Terminate sleeves flush with surface of concrete and masonry and above floors.

- .6 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water-tight, durable joint.
- .7 Voids around pipes:
 - .1 Caulk between sleeve and pipe in foundation walls and below grade floors with oakum and PC-4 caulking compound between sleeve and pipe.
 - .2 Where sleeves pass through walls or floors, caulk space between sleeve and insulation or between sleeve and pipe with dry oakum. Seal space at each end of sleeve with waterproof, fire retardant, non-hardening mastic.
 - .3 Ensure no contact between copper tube or pipe and ferrous sleeve.
 - .4 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.
- .8 Where pipes and ducts pass through walls and floors having a fire separation rating, pack the space with approved caulking material and seal in accordance with CGSB 19-GP-9.

3.9 ESCUTCHEONS AND PLATES

- .1 Install on pipes passing through finished walls, floors and ceilings.
- .2 Use chrome or nickel-plated brass, solid type with set screws for ceiling or wall mount.
- .3 Inside diameter to fit around finished pipe. Outside diameter to cover opening or sleeve.
- .4 Where sleeve extends above finished floor, escutcheons or plates to clear sleeve extension.
- .5 Secure to pipe or finished surface but not to insulation.

3.10 VIBRATION ISOLATION

- .1 Installation:
 - .1 Install vibration isolation equipment in accordance with Manufacturer's instructions and adjust mounting to level equipment.
 - .2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping and ducting passage through walls and floors do not transmit vibrations.
 - .3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to 100 mm size: first 3-points of support; 150 mm to 200 mm size: first 4-points of support; 250 mm size and larger: first 6-points of support.
 - .2 First point of support to have static deflection of twice deflection of isolated equipment, but not more than 50 mm.
 - .4 Where isolation is bolted to the floor avoid short circuiting of sound pads by using vibration isolation washers.

- .5 Block and shim level all bases so that ductwork and piping connections can be made to a rigid system at the operating level before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.11 CUTTING AND PATCHING

- .1 Minimize cutting and patching required. Set sleeves and mark openings in concrete forms and masonry structure prior to the placement of concrete or masonry.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section refers to the disinfection, hydrostatic and pressure testing of all water retaining structures and piping (new and existing).
- .2 All new water retaining or carrying pipes and surge tanks shall be tested for leakage.
- .3 Disinfect any equipment in contact with potable water.
- .4 Disinfect and clean the existing potable raw water well prior to putting the raw water well back in service.
- .5 All testing and disinfection shall be as specified herein or elsewhere in these specifications or as directed by the Engineer.
- .6 The Contractor shall furnish the suitable temporary service connections, testing plugs or caps, pressure pumps, pipe connections, gauges, thrust supports and all other required equipment and labour necessary for filling the structure, and expelling air without additional compensation.
- .7 Coordinate with local utility personnel during testing and disinfection.

1.2 REFERENCES

- .1 AWWA C652 - Disinfection of Water Storage Facilities.
- .2 AWWA C653 - Disinfection of Water Treatment Plants.

1.3 SUBMITTALS

- .1 In accordance with Division 01.
- .2 Submit work plans to detail all cleaning, disinfection, hydrostatic and pressure testing.

Part 2 Products

2.1 WATER

- .1 All water used for the initial disinfection, hydrostatic and pressure testing shall be supplied by the Owner at no cost to the Contractor.
- .2 The Contractor shall be responsible for the supply and installation of all temporary pipework, pumps and other equipment required to transport the water from the Owner's point of supply at the existing structure or piping to be tested.
- .3 The Contractor shall provide the Owner and Engineer with at least 72-hours of notice of his requirement for water for testing.

- .4 All water used for disinfection and pressure testing to be of potable quality as defined by the latest edition of the *Guidelines for Canadian Drinking Water Quality*.

2.2 CHLORINE

- .1 Chlorine used in disinfection shall be either hypochlorite solution or liquid chlorine conforming to the AWWA B300 and B301 Standard - latest edition respectively.

Part 3 Execution

3.1 CLEANING

- .1 Provide as specified in Division 01.
- .2 Prior to disinfection and/or hydrostatic or pressure testing, all water retaining structures, pipework and conduits shall be thoroughly cleaned. All dirt and loose material shall be removed.
- .3 Cleaning shall include all necessary provisions to thoroughly wash down interior surfaces and to remove all wash down water and solids from the pipe or structure.
- .4 Leave all systems operating with work areas clean to the satisfaction of the Engineer.

3.2 DISINFECTION

- .1 Provide as specified in Division 01.
- .2 Combine hydrostatic testing with disinfection procedure and submit details of proposed method to the Engineer.
- .3 Disinfection of the potable water storage reservoir and pumpwell shall be in accordance with the latest edition of ANSI/AWWA C652, Disinfection of Water Treatment Facilities shall be in accordance with the latest edition of AWWA C653. Disinfection and cleaning of the remaining non-potable tankage shall consist of flushing and hydrostatic testing using clean potable water.
- .4 The Contractor shall provide a means of testing the concentration of the chlorine disinfection solution.

3.3 MIXING OF CHLORINE SOLUTION

- .1 Mixing of chlorine solutions shall conform to the Manufacturer's instructions. Methods and procedures shall be subject to the approval of the Engineer.

3.4 DISPOSAL OF DISINFECTING AND TESTING WATER

- .1 Dispose of water used for spray disinfection and the initial testing of the pump well into the gravity sanitary sewer system at a rate, which will not cause hydraulic overloading. The Contractor is responsible for the necessary chemical to dechlorinate and equipment required to pump the test water to the drain or into existing sewage collection system. Disposal of disinfection waters to comply with Saskatchewan Water Security Agency regulations.
- .2 Disinfection of the pump well is to be in strict accordance with the Saskatchewan Water Security Agency's recommended standards for water supply and sewerage. The pump well and potable water containments will be maintained clean until acceptance by the Owner. Prior to acceptance, the water is to be tested by the local health unit to ensure potability. Disinfecting, if required, will be by the Contractor at the Contractors expense.

3.5 ENTRY INTO EXISTING OR PREVIOUSLY DISINFECTED POTABLE WATER STORAGE STRUCTURES

- .1 Pump well shall disinfected as part of the work.
- .2 Where entry is required either into existing water retaining structures or piping, or into previously disinfected new structures, the Contractor shall ensure that the following measures are taken. All personnel shall wear clean, dirt-free protective overalls and disinfected, clean rubber footwear. Such footwear shall be reserved solely for use within the affected areas and shall not be worn in undisinfected areas:
 - .1 All tools and equipment shall be clean, grease free and spray disinfected before use. Equipment which shows evidence of fuel, oil or grease leakage shall not be used.
 - .2 The immediate area surrounding the access point for the structures concerned shall be cleaned and spray disinfected prior to the start of work. All previously disinfected footwear, tools or equipment removed outside this area or the affected structures shall be re-disinfected on return.
 - .3 Disinfection of footwear, tools, equipment and access area shall be by spraying with a 200 mg/L concentrated chlorine/water solution.
 - .4 Workmen who show signs of illness shall not work within the affected structures or surrounding access area.

3.6 INSTRUMENTATION PROTECTION

- .1 All instruments that have a maximum range of less than the hydrostatic or pneumatic test pressure shall be removed or isolated during the pressure test. On successful completion of the system test, the pressure shall be lowered and re-pressured if required to a pressure within the range of the instruments and the isolated or removed instruments shall then be tested in accordance with other sections of these specifications.

3.7 PRESSURE TESTING OF PIPING

- .1 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least 5-days after placing concrete or 2-days if high early strength concrete is used.

- .2 Strut and brace caps, bends, tees and valves, to prevent movement when test pressure is applied.
- .3 Pipeline should be left at low pressure for a period of 48-hours prior to testing to saturate concrete lining where applicable.
- .4 Thoroughly examine exposed parts while under pressure and correct for leakage as necessary. Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .5 The amount of leakage during the test period shall be 0. Repeat pressure test until all defects have been corrected and no loss of water is observed.
- .6 Pressure testing shall be conducted on the pipelines to the pressures and durations as follows (or the maximum rated pressure of the pipeline whichever is less):

System	Test Pressure (kPa)	Duration (hours)
AA, AAS, ACS, CAS, CH, CS, CLS, CO, PPS, PRL, PSW, RJ, RW, SB, CLS, SACS, AL, SLPA, PLYS, ALS, PACS, CW, CIP, PERW, IA, BPW, SHS, SBS, CRS, SHDS, ANTS, PPS, FAM AQAS, FEF, FTW, PW, TW	860	4
AS, BP, CBP, CLG, SAM, VA	345	4
DR, RD	Leak test only by plugging and filling lines	4

3.8 DEFECTS AND REPAIRS

- .1 Defects disclosed in the work shall be made good and retested or the work replaced without additional cost to the Owner.
- .2 Repairs to piping systems shall be made with new material. No caulking of screwed joints, cracks or holes will be accepted. Where it becomes necessary to replace pieces or pipe, such replacements shall be the same lengths as the defective pieces. Where repairs are required to PVC pipe, the pipe shall be replaced as far as the first detachable fitting in each direction from the defect. Under no circumstances shall a new section of pipe be installed with solvent welded couplings.
- .3 Tests shall be repeated after any work has been replaced if, in the judgement of the Engineer, it is necessary.
- .4 All pressure testing shall be done in the presence of the Engineer or Owner's Representative.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section specifies hangers and supports for piping systems.
- .2 Design, select, locate and provide pipe hangers and supports for piping in accordance with the requirements of the specifications, the pipe manufacturer's requirements and as shown.

1.2 REFERENCE STANDARDS

- .1 Conform to the following reference standards:
 - .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME).
 - .2 ANSI/ASME B31.1, Power Piping, (SI Edition).
- .2 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS):
 - .1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP-69, Pipe Hangers and Supports - Erection and Application.
 - .3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .3 ULC, Underwriters' Laboratories of Canada.
- .4 WW-H-171E, Federal Specification.
- .5 Saskatchewan Plumbing Code.
- .6 CAN/CGA B149.2 Natural Gas Installation Code.

1.3 DESIGN REQUIREMENTS

- .1 Construct pipe hanger and support to Manufacturer's recommendations utilizing manufacturers regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP-58.
- .3 Ensure that supports, guides and anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

- .5 Provide sufficient load-bearing area for PVC pipe in accordance with Manufacturer's specifications.
- .6 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings and product data in accordance with Division 01.
- .2 Submit Shop Drawings and product data for following items:
 - .1 All bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.

1.5 MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporating into the manual specified in Division 01.

Part 2 Products

2.1 MATERIALS

- .1 Unless otherwise specified, pipe hangers and supports, structural attachments, fittings and accessories are to be hot-dipped galvanized after fabrication. Pipe hangers and supports which are not standard copper plated and are to be plastic coated or lined with dielectric material or neoprene, are to be hot dip galvanized before coating or lining.
- .2 Provide AISI Type 304 stainless steel nuts, bolts, washers and threaded rods, for submerged and exposed, above ground conditions. Provide cadmium plated steel nuts, bolts, washers and threaded rods in non-corrosive, controlled environment areas.
- .3 Pipe hangers and supports in submerged locations to be 304 stainless steel.
- .4 Pre-engineered pipe hangers are to be used.
 - .1 Acceptable products:
 - .1 Myatt;
 - .2 Anvil; or
 - .3 Approved equal.

2.2 PIPE HANGERS AND SUPPORTS

- .1 Type 1 - Clevis Pipe Hanger: provide carbon steel clevis hangers with configuration and components as follows:
 - .1 Steel pipe (insulated) - B-Line B3100, Grinnell Fig. 260, Superstrut C-710, or Taylor No. 24 or Hunt 32; with insulation shield.
 - .2 Steel pipe (uninsulated) - B-Line B3100, Grinnell Fig. 260, Superstrut C-710, or Taylor No. 24 or Hunt 32.
 - .3 Plastic pipe - B-Line B3100 C, Grinnell Fig. 260 (plastic coated) or Taylor No. 24 (plastic coated) or Hunt 32 (plastic coated).
- .2 Type 2 - "J" Pipe Hanger: provide carbon steel hangers with configuration and components as follows:
 - .1 Steel pipe - B-Line B3690, Grinnell Fig. 67, Superstrut C-711 or Unistrut J1205-J1280 Series.
 - .2 Steel pipe (insulated) - B-Line B3690, Grinnell Fig. 67, Superstrut C-711 or Unistrut J1205-J1280 Series; with insulation shield.
- .3 Type 3 - Pipe Clamp: provide carbon steel pipe clamps, with configuration and components as follows:
 - .1 Steel pipe (insulated) - Double Bolt Pipe Clamp: B-Line B3144 or Grinnell Fig. 295 or Hunt 70H.
 - .2 Steel pipe (uninsulated) - Single Bolt Pipe Clamp: B-Line B3140 or Grinnell Fig. 212 or Hunt 60.
- .4 Type 6 - Framing Channel Pipe Clamp: provide steel pipe clamps with configuration and components as follows:
 - .1 Steel pipe (uninsulated) - B-Line 2007, Powerstrut PS1100 or Unistrut P1109 Series.
 - .2 Steel pipe (insulated) - B-Line 2007, Powerstrut PS1100 or Unistrut P1109 Series; with insulation shield.
- .5 Type 7 - U-Bolt: provide carbon steel U-bolts with configuration as follows:
 - .1 Steel pipe (uninsulated) - Grinnell Fig. 137, B-Line B3188 or Superstrut H-115, or Hunt 80.
 - .2 Steel pipe (insulated) - Grinnell Fig. 137, B-Line B3188 or Superstrut H-115 or Hunt 80 with insulation shield.
- .6 Type 9 - Welded Pipe Stanchion: provide a carbon steel, standard schedule pipe stanchion, cut stanchion to match contour of pipe elbow. Use only for ambient commodity systems.
- .7 Type 10 - Pipe Stanchion saddle: provide carbon steel saddles and yokes as follows:
 - .1 Steel pipe (insulated) - B-Line B3090, Grinnell Fig. 259 or Hunt 500S; with insulation shield.
 - .2 Steel pipe (uninsulated) - B-Line B3090, Grinnell Fig. 259 or Hunt 500S.
 - .3 Cast and ductile iron pipe - B-Line B3090 DI, Grinnell Fig. 259 or Hunt 500S.

- .4 Copper pipe (uninsulated) - B-Line B3090, Grinnell Fig. 259 or Hunt 500C; with insulation shield or lined with dielectric material.
- .8 Type 12 - Riser Clamp: provide carbon steel riser clamps with configuration and components as follows:
 - .1 Steel pipe - B-Line B3373, Grinnell Fig. 261, Superstrut C-720 or Taylor No. 82, or Hunt 40.
 - .2 Cast and ductile iron pipe - B-Line B3373, Grinnell Fig. 261, Superstrut C-720, on Taylor No. 82 or Hunt 40.
 - .3 Plastic pipe - B-Line 3373C, Grinnell Fig. 261 (plastic coated), Superstrut C-720 (plastic coated), Taylor No. 82 (plastic coated) or Hunt 40 (plastic coated).
- .9 Type 13 - Framing Channel Pipe Strap: provide carbon steel pipe strap with configuration as follows:
 - .1 Steel pipe (uninsulated) - B-Line B2400 Series, Powerstrut PS3126, Superstrut C-708-U, or Unistrut P2558 Series, or Hunt 67.
 - .2 Steel pipe (insulated) - B-Line B-2400 Series, Powerstrut PS3126, Superstrut C 708-U, or Unistrut P2558 Series, or Hunt 67; with insulation shield.
 - .3 Plastic pipe - B-Line B-2400 Series, Powerstrut PS3126, Superstrut C-708-U, or Unistrut P2558 Series, or Hunt 67. Use only if hanging pipe below framing channel.

2.3 RACK AND TRAPEZE SUPPORTS

- .1 Unless otherwise specified, provide steel trapeze and pipe rack components having a minimum thickness of 2.7 mm with a maximum deflection $1/240$ of the span.
- .2 Type 20 - Trapeze Pipe Support: provide trapeze pipe support cross members. Provide 41 mm square carbon steel flat plate fittings of standard design manufactured by framing channel manufacturer, B-Line B202-2, Powerstrut PS619 or Unistrut P2471.
- .3 Type 21 - Pipe Rack Support: provide post and cross member framing channels. Provide carbon steel pipe rack fittings of standard design manufactured by framing channel manufacturer. Provide gusset type, 90 fittings B-Line B844, Grinnell PS3373 or Unistrut P2484.

2.4 STRUCTURAL ATTACHMENTS

- .1 Type A - Malleable Iron Concrete Insert: provide malleable iron concrete inserts with insert nuts; B-Line B3014 with B3014N, Grinnell Fig. 282 or Unistrut M26 with M2808 through M2824.
- .2 Type B - Side Beam Bracket: provide malleable iron or carbon steel bracket; Grinnell Fig. 202, or B-Line B3062 or Hunt 50.
- .3 Type C - Malleable Beam Clamp with Extension Piece: provide malleable iron clamp and extension pieces with steel tie rods; Grinnell Fig. 218 with Fig. 157 extension piece, or B-Line B3054 with Fig. B3203 extension piece, Hunt 812.

- .4 Type D - Steel Beam Clamp with Eye Nut: provide forged steel beam clamps and weldless eye nuts; Grinnell Fig. 292, B-Line B3291 series.
- .5 Type E - Steel channel clamp: provide malleable iron clamp and heel plates, and steel bolts and nuts; Grinnell Fig. 226 with Fig. 157 extension piece.
- .6 Type F - Welded Beam Attachment: provide carbon steel beam attachments; B-Line B3083, or Grinnell Fig. 66 or Hunt 52B.
- .7 Type G - Adjustable Beam Attachment: provide carbon steel beam attachments; B-Line B3082 or Hunt 50S.
- .8 Type H - Double Channel Bracket: provide single channel attachment. Provide a carbon steel double framing channel cantilever bracket assembly; B-Line B297-12 through B297-36, Powerstrut PS809 or Unistrut P2542 series.
- .9 Type J - Single Channel Bracket: provide single channel attachment. Provide a carbon steel single framing channel cantilever bracket assembly; B-Line B198-6 through B198-24, Powerstrut PS661 or Unistrut P2231 through P2234.
- .10 Type K - Wall mounted channel: provide 41 mm x 62 mm carbon steel framing channel; B-Line B12 or Unistrut P5500.
- .11 Type L - Pipe stanchion attachment: provide minimum 12 mm thick carbon-steel baseplate. Anchor bolt holes: 1.6 mm larger than bolt diameter. Provide non-shrink grout between the baseplate and upstand.
- .12 Type M - Welded Steel Bracket: provide carbon steel brackets which comply with MSS Type 32 and FEDSPEC Type 33 for medium welded bracket; Grinnell Fig. 195. Heavy welded bracket to comply with MSS Type 33 and FEDSPEC Type 34; Grinnell Fig. 199.
- .13 Type P - Framing Channel Post Base: provide carbon steel post bases of standard design manufactured by framing channel Manufacturer. Single channel: Unistrut P 2072A, B-Line B280, Powerstrut PS 3033. Double channel: Unistrut P2073A, B Line B281 or Powerstrut PS3064.
- .14 Type Q - Continuous concrete inserts: provide 300 mm long carbon steel concrete inserts; Unistrut P3253.

2.5 ACCESSORIES

- .1 Hanger rods: provide AISI Type 304 stainless steel rods, threaded on both ends or continuous threaded and sized as required.
- .2 Weldless eye nut: provide forged steel eye nuts and comply with MSS and FEDSPEC Type 17; Grinnell Fig. 290, or B-Line B3200 or Hunt 88.
- .3 Welded eye rod: provide carbon steel eye rods with eye welded closed. Inside diameter of eye to accommodate a bolt diameter 3.2 mm larger than the rod diameter; Grinnell Fig. 278, or B-Line B3211 or Hunt 95R.

- .4 Turnbuckle: provide forged steel turnbuckles; Grinnell Fig. 230, or B-Line B3202 or Hunt 84.
- .5 Framing channels: provide 41 mm x 62 mm roll formed carbon steel framed channel, having a thickness of 2.7 mm. Channel to have a continuous slot along one side with in-turned clamping ridges. Single Channel: Unistrut P5500, B-Line B12, Powerstrut PS150. Double Channel: Unistrut P5501, B-Line B12A, Powerstrut PS 150 2T3.

2.6 THERMAL PIPE HANGER SHIELD

- .1 Provide thermal shields or protective saddles on pipe requiring insulation. Type 3, Type 11 and Type 12 hangers clamp directly to pipe therefore thermal shields are not required but insulation shall be continued around the hangers.
- .2 The shield consists of an insulation layer encircling the entire circumference of the pipe and a steel jacket encircling the insulation layer. Minimum shield length is as follows:

Pipe (mm)	Shield Length (mm)
12 - 38	100
50 - 150	150
200 - 250	225
300 - 450	300

- .3 Thermal shield to same thickness as the piping system insulation.
- .4 Use standard shield for hot systems and vapour barrier shield for cold systems.
- .5 Use stainless-steel band clamps to ensure against slippage between the pipe wall and the thermal shield.
- .6 Standard shield:
 - .1 Insulation:
 - .1 Hydrous calcium silicate, high density, waterproof.
 - .2 Compressive strength: 700 kPa average.
 - .3 Flexural strength: 500 kPa average.
 - .4 R. unit: 2.16 at 37.8°C mean.
 - .5 Temperature range: -7°C to 260°C.
 - .2 Steel jacket: galvanized-steel, thickness as per Manufacturer's standard, supplied for the given pipe size. For pipe in "submerged" location, provide stainless steel jacket.
 - .3 Connection: steel jacket and insulation to be flush with end of thermal shield. Butt connect shield to pipe insulation.
- .7 Vapour barrier shield:
 - .1 Insulation:
 - .1 Hydrous calcium silicate, high density, waterproof.
 - .2 Compressive strength: 700 kPa average.
 - .3 Flexural strength: 500 kPa average.
 - .4 R. unit: 2.16 at 37.8°C mean.
 - .5 Temperature range: -7°C to 260°C.

- .2 Steel jacket: galvanized steel, thickness as per Manufacturer's standards, supplied for the given pipe size. For pipe in "submerged" location provide stainless steel jacket.
- .3 Connection: insulation to extend 25 mm each side of steel jacket for vapour tight connection to pipe insulation vapour barrier. Butt connect shield to pipe insulation.

Part 3 Execution

3.1 HANGER AND SUPPORT LOCATION

- .1 Hanger and support spacing to be designed in strict accordance with ANVIL "Pipe Hanger Design and Engineering" book.
- .2 Design and locate hangers and supports as near as possible to concentrated loads such as valve, flanges, etc. Locate hangers, supports and accessories within appropriate span lengths to support continuous pipeline runs unaffected by concentrated loads.
- .3 Provide hangers and/or base supports within 1 m of each change in direction on each leg, on one side of each valve and on the first spool piece or fitting extending from a piece of equipment:
 - .1 For PVC pipe, concentrated loads, such as valves, are to be supported directly, or where impractical, directly adjacent to the load.
- .4 Locate hangers and supports to ensure that connections to equipment, tanks, etc. are substantially free from loads transmitted by the piping.
- .5 Support piping so that temporary pipe supports will not be required when removing parts of the piping system for equipment maintenance.
- .6 Support piping so that no pockets will be formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.
- .7 Provide supplementary structural steel members where structural bearing does not exist or where inserts are not in suitable locations.
- .8 Use approved constant support type hangers where:
 - .1 Vertical movement of pipe work is 13 mm or more.
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.

3.2 INSTALLATION

- .1 Unless otherwise specified, do not drill or burn holes in the building structural steel.
- .2 Do not use hanger components for purposes other than for which they were designed. Do not use hanger components for rigging and erection purposes.
- .3 Install items to be embedded before concrete is poured. Fasten embedded items securely to prevent movement when concrete is poured.

- .4 Use embedded anchor bolts instead of concrete inserts for support installations in areas below water surface or normally subjected to submerging.
- .5 Install thermal pipe hanger shields on insulated piping at required locations during hanger and support installation. Butt joint connections to pipe insulation to be made at the time of insulation installation in accordance with the Manufacturer's recommendation.
- .6 Hanger and support components in contact with plastic pipe to be free of burrs and sharp edges.
- .7 Rollers to roll freely without binding.
- .8 Finished floor beneath Type L structural attachments and framing channel post bases to be roughened prior to grouting. Grout between base plate and floor to be free of voids and foreign material.
- .9 Cut and drill baseplates to specified dimensions prior to welding stanchions or other attachments and prior to setting anchor bolts.
- .10 Provide plastic or rubber end caps at the exposed ends of all framing channels that are located up to 2200 mm above the floor.
- .11 Recoat ends of framing channels cut to length with zinc dust-zinc oxide coating.
- .12 Include any piping support modifications on the shop drawings submitted prior to fabrication or installation.
- .13 Review the drawings prior to installation of piping, conduit and fixtures by this or any other Division. Identify any conflicts and confirm the routing of each section of pipe work prior to commencement of installation. Advise of any conflicts with existing services. Where necessary, amend the routing of pipe work to avoid conflict and provide shop drawings showing proposed routing.
- .14 Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.
- .15 All minor modifications to accommodate installed equipment and structural components are subject to review. Do not commence work on related piping until Engineer's review is complete.

3.3 ADJUSTMENTS

- .1 Adjust hangers and supports to obtain required pipe slope and elevation. Use shims made of material that is compatible with the piping material. Adjust stanchions prior to grouting of baseplates.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submit product data in accordance with Division 01.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in Division 01.

1.3 SHIPMENT, PROTECTION AND STORAGE

- .1 Deliver valves to site using loading methods which do not damage casings or coatings.
- .2 Clearly tag valves, stating size, type, coatings and mating parts.
- .3 Store on site until ready for incorporation in the work using methods recommended by manufacturer to prevent damage, undue stresses or weathering.

Part 2 Products

2.1 GENERAL

- .1 Provide valves of the same type, size range and service from a single Manufacturer.
- .2 Provide new, unused valves for the work.
- .3 Valve materials to be free from defects or flaws, with true alignment and bores.
- .4 Unless otherwise indicated, valves shall be the same size as the pipe run in which they are to be installed.
- .5 Clearly mark valve bodies in raised lettering to indicate the valve type, rating and where applicable, the direction of flow. Conform to MSS SP25.
- .6 Provide padlockable lockout feature on all sizes of the following valve types:
 - .1 Automated control valves (electric and pneumatic): FCV, LCV, PCV and XV only.
 - .2 Specialty valves: FV and PRV only.
 - .3 Manual isolation and shut-off valves: AV, BD, BF, BV, DV, GL, GV, KV, PD, PN, PV and TW only.
- .7 Valves to open counter-clockwise.

2.2 DRAWINGS

- .1 Process schematics indicate major process valves required for the process to operate as intended.
- .2 Detailed process drawings, HVAC drawings, process standard drawings, and service piping schematics indicate the valves on the process schematics plus other valves required for isolation.
- .3 In pipe runs, less than 100 mm diameter, in addition to the valves indicated on the P&IDs, detailed drawings and standard drawings, provide isolation valves in straight pipe runs at intervals no greater than 60 m and at takeoffs to individual services. Provide ball isolation valves in pipe of 65 mm diameter and less, or in pipe of less than 100 mm diameter and carrying solids. Provide butterfly isolation valves in pipe of 75 mm diameter and greater and not carrying solids.
- .4 In pipe runs carrying sludge or scum tap bottom of pipe at low point of runs and install short nipple and valve.
- .5 Provide valves and taps on top of pipe at high point in all liquid pipe runs greater than 60 m length where the change in slope exceeds 4%.
- .6 Provide flushing connections and valves as shown in standard details, at 30 m intervals on any primary sludge, primary and thickener scum and thickened secondary sludge lines.
- .7 Unless otherwise specified, provide gate valves 400 mm and larger with a bypass valve sized in accordance with AWWA C500.

2.3 VALVE ENDS

- .1 In pipe runs less than 75 mm diameter provide valves with female threaded ends, unless indicated otherwise. Threads to conform to ANSI B1.20.1.
- .2 Valves in pipe run equal to or greater than 75 mm diameter to be flanged unless indicated otherwise.
- .3 For cast iron body valves, drill flanges to Class 125 pattern conforming to ANSI B16.1. For steel body valves, flanges to be Class 150 pattern or Class 300 pattern conforming to ANSI B16.5 or as noted.
- .4 Do not use grooved joint valve ends.
- .5 Use flanged joints for buried and exterior valves. Flanges to be compatible with pipe and jointing technique used.
- .6 Use flanged joints for buried butterfly valves.
- .7 Lug style wafer body valves shall have tapped holes, suitable for the bolt spacing of the pipe flanges placed on either side.

- .8 Wafer body valves shall have positioning holes, suitable for the bolt spacing of the pipe flanges placed on either side.
- .9 End flanges for gate valves to be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1, Class 125 flanges.

2.4 MANUAL OPERATORS

- .1 Provide valves with manual operators from same manufacturer unless specifically indicated otherwise.
- .2 For hand wheels, clearly show direction of opening in raised lettering and symbols.
- .3 Hand wheel diameter to conform to the following:

Nominal Valve Size (mm)	Minimum Hand Wheel Diameter (mm)
12	50
20	50
25	60
38	75
50	85
65	105
75	200
100	250
150	300
200	350
250	400
300	450
350	450
400	550
450	600
500	600
600	600

- .4 Maximum rim pull on a hand wheel not to exceed 300 N when one side of the valve is at test pressure and the other side is at atmospheric pressure. Provide gear operator where a shaft mounted hand wheel would require greater than this force to operate. Unless different operators are scheduled or shown in the drawings, conform to the following minimum requirements:
- .1 Gate valves: less than 300 mm, hand wheel; equal to or greater than 300 mm, gear operator.
 - .2 Knife gate valves: less than 300 mm, hand wheel; equal to or greater than 300 mm, gear operator.
 - .3 Globe and needle valves: less than 200 mm, hand wheel; equal to or greater than 200 mm, gear operator.
- .5 Match existing operating nuts. Provide two 8-point operating wrenches.
- .6 Lever operators to conform to the following dimensions:

Nominal Valve Size (mm)	Minimum Length of Lever (mm)
6	80
12	80
20	100
38	150
50	150
65	150
75	175
100	225
150	250
200	300
250	450
300	450

- .7 Quarter turn lever operators to be perpendicular to the pipe run when the valve is closed.
- .8 Lever operators on ball valves to be two positions. Provide butterfly valves with 10 position latching levers except where used to balance air flows. Where used to balance air flows, provide infinite position, screw down levers.
- .9 Maximum pull at the end of the lever arm not to exceed 300 N when one side of the valve is at test pressure and one side is at atmospheric pressure. Provide a gear operator where greater than this force would be required to operate the valve with a lever. Conform to the following minimum requirements unless different operators are scheduled or shown in the drawings:
- .1 Ball valves: less than 150 mm, lever operator; greater than or equal to 150 mm, gear operator.
 - .2 Butterfly valves: less than 250 mm, lever operator; greater than or equal to 250 mm, gear operator.

- .10 Gear operator to be worm gear type, equipped with a hand wheel and a visual indicator of the valve position. Equipment operators with adjustable, self-locking mechanical stop-limiting devices designed to hold the valve in any intermediate position between full open and full closed to prevent over-travel of the disc/ball in the open and closed positions. Gear operators to be grease lubricated. Where gear operators are intended for direct bury or submergence, seal units with long life lubricant.
- .11 Manual operators for butterfly and gate valves for buried service to include an AWWA operating nut and be gasketed and grease packed for submerged operation at water pressures to 700 kPa. Operators for exposed service to be gasketed for weatherproof service. Gear boxes to be placed above ground and liquid surfaces.
- .12 Gear and manual operators for submerged service to be permanently lubricated and sealed for operation at water pressures to 700 kPa. Provide floor box, extension stem kit with nut, stem and connector. Extension stems and connectors to be 316SS.
- .13 Provide chain wheel gear operators for manual valves on lines 75 mm and greater, mounted over 1.8 m above the operating floor. Design the operator so that a force of 150N is sufficient to open the valve when one side of the valve is at test pressure and the other side is at atmospheric pressure. The chain pulley to mesh positively with the chain. Chain to extend from valve operator to operating height 1.2 m above the floor or as directed by the Engineer. Exact dimensions to be field determined. Provide approved chain hooks where required to prevent chain from hanging within traffic paths.

2.5 VALVE STEM EXTENSIONS

- .1 Provide valve stem extensions where additional clearance is required for pipe insulation or where valve operation without the extension is difficult and in manholes.
- .2 Where angle valve stem extensions are employed, they shall be angle geared. Universal joint types are not permitted.

2.6 BUTTERFLY VALVES

- .1 Size: 50 mm diameter and larger.
- .2 Tags: BUV.
- .3 Number: refer to P&ID Drawings.
- .4 Rating: 1050 kPa (150 psi) working pressure.
- .5 Body: ductile iron, lug style.
- .6 Disk: nylon 11 coated Ductile Iron.
- .7 Stem: stainless steel 316.
- .8 Seat: EPDM.
- .9 Stem packing: NBR.

- .10 Bushing: polyester.
- .11 Acceptable products:
 - .1 Bray series 30/31 with thickness of 76 μ m to 152 μ m (3 mils to 6 mils) Polyester powder exterior coating; or
 - .2 Approved equal.

2.7 CHECK VALVE

- .1 Size: 20 mm diameter and larger.
- .2 Tags: CHV.
- .3 Number: refer to P&ID Drawings.
- .4 Type: center guided silent check:
 - .1 Body: ductile iron, swing-check style.
 - .2 Trim: bronze/stainless steel.
 - .3 Disc: alloy steel and nylon reinforcement, Buna-N.
 - .4 Minimum pressure rating: 1730 kPa (250 psi).
 - .5 Coating: interiors/exterior to be coated with fusion bond epoxy ANSI/NSF 61 approved.
 - .6 Connection type: ASME B16.42 Class 150 Flange
 - .7 Acceptable Manufacturers:
 - .1 Val-Matic Swing-Flex series; or
 - .2 Approved equal.

2.8 SURGE RELIEF VALVE

- .1 Tags: SRV.
- .2 Number: refer to P&ID Drawings.
- .3 Body type: globe, full-port.
- .4 Type: pilot controlled, hydraulically driven, diaphragm actuated, pressure reducing.
- .5 End conn: flanged connection.
- .6 Body: ductile iron.
- .7 Diaphragm: Buna-N.
- .8 Stem, nut and spring: stainless steel.
- .9 Pressure reducing and anticipating pilots adjustable.
- .10 Pressure relief pilot factory setting: 130 psi.

- .11 Surge anticipating pilot factory setting: 50 psi.
- .12 Trim: stainless-steel.
- .13 Tubing and fittings: copper, brass.
- .14 Visual position indication.
- .15 Strainer and needle valve.
- .16 Coatings: interior/exterior to be coated with fusion bond epoxy ANSI/NSF 61 approved.
- .17 Acceptable Manufacturer:
 - .1 Cla-Val; or
 - .2 Approved equal.

2.9 AIR RELIEF VALVE

- .1 Tags: ARV.
- .2 Number: refer to P&ID Drawings.
- .3 Body: cast iron:
 - .1 End conns: 25 mm NPT.
 - .2 Stainless steel trim and float and Buna-N seat with stainless steel flow diffuser screen.
 - .3 Rating: 1035 kPa (150 psi).
 - .4 Coating: Fusion bond epoxy ANSI/NSF 61 approved.
 - .5 Acceptable products:
 - .1 Valmatic VM-15A; or
 - .2 Approved equal.

2.10 SOLENOID CONTROLLED PUMP CONTROL VALVE

- .1 Body: ductile iron, globe-style, full-port.
- .2 Diaphragm: Buna-N.
- .3 Power supply: 120 V AC.
- .4 Coating: NSF/ANSI 61 fusion bonded epoxy.
- .5 Pressure rating: 250 psi.
- .6 Connection: ASME B16.42 150 class flange.
- .7 Additional components: solenoid control, limit switch assembly, anti-cavitation trim, flow control needle valve, pilot system strainer, and union:

- .1 Valve shall be equipped with limit switches for both valve open status and valve closed status.

.8 Acceptable Products:

- .1 Cla-Val, 61-02KO Deep Well Pump Control Valve.
- .2 Approved equal.

2.11 BALL VALVE FOR STEEL PIPE

- .1 To: MSS SP-72 1000 psi WOG.
- .2 Body: cast steel.
- .3 Ball: stainless-steel 316.
- .4 Stem: stainless-steel 316.
- .5 Package: PTFE.
- .6 Seals: PTFE.
- .7 Operator: lever.
- .8 End cons: threaded-NPT.
- .9 Acceptable Product:
 - .1 Flow-Tek.
 - .2 Crane.
 - .3 Kitz.

2.12 BLEED VALVE FOR INSTRUMENTS

- .1 To ASME specifications.
- .2 Body: stainless-steel 316.
- .3 Stem: chrome plated stainless-steel 316.
- .4 Vent tube: stainless-steel 316.
- .5 Backstop screw: stainless-steel 316.
- .6 Approved Product: Swagelok bleed valves.

Part 3 Execution

3.1 PREPARATION

- .1 Valve and piping arrangement indicated in the drawings is based on typical dimensions for valves of the specified type. Make the necessary modifications in piping to allow for discrepancies between valve dimensions shown and those supplied for the work.
- .2 Field measure and check all equipment locations, pipe alignments and structural installation prior to installation of valves. Ensure that valve locations and orientations provide suitable access to manual operators and that sufficient space and accessibility is available for pneumatic and electric actuators.
- .3 Where conflicts are identified, inform the Engineer and initiate the necessary piping modifications at no cost to the Owner.

3.2 VALVE INSTALLATION

- .1 In horizontal pipe runs, other than in locations where space does not permit, mount all valves except for butterfly valves and trunnion ball valves with a vertical operating shaft with the actuator at the top. In no case install a valve with the operator shaft pointing down.
- .2 Mount butterfly valves and trunnion ball valves with shaft in a horizontal orientation.
- .3 Do not over-torque bolts to correct for misalignment when joining valves to pipe or fittings.
- .4 Support valves in position using temporary supports until valves are fixed in place.
- .5 Permanently support valves to prevent transmission of loads to adjacent pipework and/or equipment.
- .6 Generally, pipe supports and hangers are not shown unless for indication purposes only.
- .7 Install gate valves in the closed position.
- .8 Install valves which are bubble tight in 1 direction to seal in a direction opposite to normal flow unless otherwise noted or directed by the Engineer.
- .9 Unless otherwise specified, install single seated ball valves and knife gate valves with the seat downstream. Install at tank connections with seat away from tank. Install on pump discharge and suction lines with seat adjacent to the pump.
- .10 Install all valves in accordance with Manufacturer's recommendations.
- .11 Protect valves installed below grade with a shrink sleeve or polyethylene sheath attached to the pipe with tape wrap.

3.3 VALVE TESTING

- .1 Operate valves under simulated and/or real process conditions to ensure operation as intended.
- .2 Valves to be pressure tested in conjunction with the pipes in which the valves are installed.

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 This section contains detailed piping specifications and includes general specifications related pipe joints, fittings and valves.

1.2 PIPING IDENTIFICATION

- .1 The drawings designate the size and line service specification of pipe to be supplied by the Contractor in the following manner:

- .1 Line identification: line identification is placed on each line in the following manner:

150 - PW - A1 - A - D - 105

Where:

150	Line Size
PW	Commodity
A1	Piping Line Code
A	Internal Lining
D	External Pipe Coating
1	Plant Component (if required)
05	Line Number (if required)

e.g., 150 mm line size, potable water, steel -1900 kPa rating, cement mortar lined, yellow jacket coated, component 1, Line No. 05.

- .2 Commodity symbols for line identification

SYMBOL	COMMODITY
AIR	Air
AWS	Air Wash Supply
BFW	Boiler Feed Water
BW	Boiler Water
BWS	Backwash Supply
BWW	Backwash Waste
CA	Compressed Air
CHW	Chemical Waste, Chemicals, Chemical Spills and Lab Waste, PVC Drainage
CIPR	Clean-in Place Return
CIPS	Clean-in Place Supply
CLS	Chlorine Solution
CWR	Cooling Water Return
CWS	Cooling Water Supply
CWW	Cooling Water Waste
DCW	Domestic Cold Water (Potable)
DHW	Domestic Hot Water (Potable)
DRN	Drains
EE	Engine Exhaust
FEF	Filter Effluent
FTW	Filter to Waste
IA	Instrument Air

OF	Overflow
PRL	Pressure Relief Line
PSW	Plant Service Water (non-potable)
PW	Potable Water
RW	Raw Water
SA	Service Air
SAM	Sample Line
SBS	Sodium Bisulphite Solution
SEL	Sensing Line
SD	Storm Drain
SW	Sanitary Waste
TW	Treated Water (intermediate quality between raw and potable, non-chlorinated)
UA	Utility Air
VE	Vent
WW	Wastewater

- .3 Line codes: the following is a description of the general line code classifications. For specifics, refer to the appropriate commodity sheet.

Pipe or Line Codes	Flange Ratings	Basic Material	Maximum Design Pressure	Maximum Design Temp.	Suitable Services
H1	Sch. 40S	Stainless 5000 kPa Steel		60°C	DR, FEF, FTW, NG, OV, PSW, PW, PWW, RSW, RW, SAM, TW, VE, CWS

- .4 Special treatment code:

SYMBOL	DESCRIPTION
(A)	Cement mortar lining
(B)	Internal hot applied coal tar lining
(C)	Internal epoxy lined
(D)	Yellow jacket coated
(E)	External hot applied coal tar lining
(F)	External epoxy coated
(G)	Insulated
(H)	Flexible elastomeric insulation
(I)	Insulation c/w jacket (high temperature)
(J)	Painted

.5 Detailed piping specifications as follows:

SERVICE: as shown on the drawings		LINE CODE: H1
PRIMARY FLANGE RATING: CLASS 150		DESIGN PRESSURE: 820 kPa
TEMPERATURE (MAX): 40°C		CORROSION ALLOWANCE: N/A
ITEM	SIZES	GENERAL DESCRIPTION
Pipe	All sizes	Austenitic stainless steel to ASTM A312 Grade TP316, Sch. 40.
Flanges	15 mm to 50 mm	Forged stainless steel to ASTM A182 F316, ANSI B16.5
	65 mm and up	Austenitic stainless steel to ASTM 182 Grade TP316 to ANSI 16.5 with pressure rating equal or greater than pressure rating of pipe.
Fittings	50 mm & less	Forged stainless steel to ASTM A182, F316, ANSI B16.11, Class 3000, socket weld.
	65 mm and up	Austenitic stainless steel to ASTM A403, CR316, MSS-SP-43, Sch. 40, Butt-weld.
Gaskets	All sizes	Non-metallic, non-asbestos, flat ring.
Strainers	50 mm and smaller	Iron body, Y pattern, screwed, 20 mesh monel screen, Crane Fig. 998 1/2; Red-White/Toyo Fig. 380, SS screen or as approved.
	50 mm larger	Red-White Fig. 381, SS screen or as approved.
Flange Adapters	100 mm to 400 mm	Steel flange adapter with Class 150, AWWA C207 Flat face flange or raised face where required. Product: Dresser Style 128 or as approved. Coating per Section 09 91 00.

END OF SECTION

Part 1 General

1.1 CODES

- .1 Do all work associated with the welding process, such as procedure qualification, welder qualification, line-up, welding and weld testing, in accordance with the latest edition of ANSI B31.3, CSA B51, CSA Z662 and AWWA C206, except when the terms of these standards are added to or modified by these specifications.

Part 2 Products

2.1 FILLER MATERIAL

- .1 Shielded metal arch electrodes (manual welding) to conform to CSA W48.3. Grade to be of tensile strength equivalent to or greater than the ultimate tensile strength of the parent metal and to be suitable for the electric current characteristics, position of welding and other conditions of intended use.

2.2 EQUIPMENT

- .1 Welding equipment to be 200 A or larger dc machines, and to be designed and maintained in an acceptable condition to obtain the specified results.

Part 3 Execution

3.1 GENERAL

- .1 Welding to be performed using procedures qualified to CSA Z662 Surfaces to be welded shall be smooth, uniform, free of fins, lamination, tears, slag, grease, paint and other deleterious conditions which might adversely affect welding. All aspects of the process as outlined in CSA Z662 shall conform to the welding procedure specification.
- .2 Contractor to submit 5 copies and 1 electronic copy of proposed welding procedure to Engineer using the forms provided at the end of this section. Procedure to be used to prepare the test joints required for qualification.

3.2 WELDERS QUALIFICATIONS

- .1 Welding qualifications to be in accordance with CSA B51.
- .2 Use qualified and licensed welders possessing certificate for each procedure to be performed from authority having jurisdiction.
- .3 Furnish welder's qualifications to Engineer.
- .4 Each welder to possess identification symbol issued by authority having jurisdiction.

3.3 QUALIFICATION OF THE WELDING PROCEDURE

- .1 Contractor to prepare test joints in accordance with the proposed welding specification and as stated in the proposed welding procedure submitted to the Engineer. Contractor to give Engineer written notice of when and where the welding of the test joints will take place so that the Engineer can be present. Test joints to be tested at Owner's expense, and in accordance with CSA Standard Z662. Upon qualification, no change in the procedure will be permitted without the Engineer's written approval.

3.4 WEATHER CONDITIONS (FIELD WELDING)

- .1 Welding shall not be done when the quality of the completed weld would be impaired by prevailing weather conditions, including but not limited to moisture, blowing sands, high winds or low temperatures. Windshields may make conditions for welding satisfactory.
- .2 If, in the opinion of the Engineer, protection from prevailing weather conditions is necessary, then welding shall cease until this protection has been placed correctly. The Contractor will not be compensated for "downtime" delays of this nature.
- .3 Metal surfaces in and adjacent to the welding groove to be dry before welding commences and while welding is in progress.
- .4 When ambient temperature is below 0°C, welding operations to cease, unless an appropriate welding procedure has been qualified.

3.5 PRODUCTION WELDING

- .1 No pup shorter than 1 m or 3 pipe diameters, whichever dimension is greater to be installed in the line. There shall be at least one full joint of pipe installed between pups which are shorter than 5 m. All pups must be moved ahead on a current basis and installed in the line.
- .2 No two weld beads shall be started or stopped in the same location. Each weld pass shall be visually examined and any defects (i.e., pin holes, slag inclusions, gas pockets and undercutting, etc.) shall be repaired prior to welding the next pass.
- .3 Striking the arc on the pipe at any point other than the welding groove shall not be allowed. Any section of pipe which has been arc burned may, at the Engineer's discretion, be cut out and replaced at the Contractor's expense.
- .4 No weld to be subjected to sudden variations in temperature and no welded sections to be subjected to stresses, due to movement of pipe, loading on pipe, etc., until the welds have cooled below 38°C. Damage caused by the welded pipe being subjected to stresses before complete cooling of welds to be corrected at the Contractor's expense.
- .5 All temperatures to be measured by pyrometric crayons or other suitable devices approved by the Engineer.
- .6 All passes to have no more than 5-minute elapse between the previous pass termination and the commencement of the next pass. When ambient temperature is below 0°C, maximum lapse time allowable is 4-minute.

- .7 Use inert gas backing for stainless steel welding. Solar flux prohibited for liquid commodity piping.
- .8 For stainless steel pipes carrying solids-containing liquids or slurries pickle all joints and heat affected zones on interior and exterior. Use of pickling paste subject to Engineer's review. Observe regulatory requirements for disposal of acid.
- .9 Passivate exterior of all stainless-steel welds after completion. Neutralize and rinse joints.

3.6 LINEUP CLAMPS

- .1 Use of line-up clamps to conform to CSA Z662. Internal line-up clamps to be used whenever practicable and when used shall not be removed until root bead is complete. External line-up clamps may be used only when use of internal line-up clamps is not practicable. Root bead segments used in connection with external line-up clamps to be uniformly spaced around the circumference of the pipe, and to have an accumulative length of not less than 50% of the pipe circumference before the clamp may be removed. Pipe to remain supported and stationary until root bead is completed.

3.7 CLEARANCE

- .1 Clearance to be in accordance with CSA Z662. When the pipe is welded in a trench, bell hole to be of sufficient size to provide the welder or welders ready access to the joint so that their skill is not impaired. When pipe is welded above ground, the working clearance around the pipe at the weld shall be not less than 400 mm.

3.8 PIPE HANDLING

- .1 Extreme care to be exercised to prevent damage to pipe. Damage to be repaired as directed by the Engineer and at the expense of the Contractor. Bevel ends to be repaired if damaged.
- .2 All dents in the pipe deeper than 3.20 mm to be removed by cutting dented portion of the pipe out, rebeveling the cut ends, welding and recoating.

3.9 INSPECTION

- .1 Inspection will be conducted in accordance with CSA Z662. After completion of the welding operation, pipe to be left uncoated for a period sufficient to permit Engineer to carry out tests on the welds. Contractor to allow a reasonable time for Engineer to conduct tests on the tie-in welds.
- .2 Work performed will be rigidly inspected. Such inspection shall not relieve Contractor of responsibility for performing work in conformance with the specifications. Contractor to notify Engineer in advance of performing any work in order that inspection may be arranged. Engineer may reject any work that does not comply with the specified requirements. Contractor furnish the Engineer reasonable facilities and space for inspection, testing and obtaining any information Engineer desires respecting the character of material used and progress and condition of the work.

- .3 Engineer may use any method of inspection necessary to establish quality control and ensure adherence to welding procedures. Engineer has the right to accept or reject any weld not meeting the approved procedures and/or specified requirements.
- .4 Welds are subject to radiographic inspection, the cost of which will be borne by the Owner unless tests prove the weld defective. Radiographic inspection to be carried out by operators certified in conformance with CSA W178.
- .5 Non-destructive testing standards specified in CSA Z662 to be used as criteria for weld acceptability.
- .6 Criteria regarding destructive testing procedure and requirements specified in CSA Z662 to be used.

3.10 REPAIR OR REMOVAL OF WELD DEFECTS

- .1 Repair or removal of weld defects to be in accordance with CSA Z662. Backwelding is not allowed without qualification of the welding procedure used.
- .2 All costs for repairing defective welds, including radiographic inspection of the corrected work, to be borne by the Contractor.

3.11 COATED PIPE PROTECTION AND FIELD COATING

- .1 Protect and prepare for field welding all pipe which has been previously coated.
- .2 After field welding, pipe coating of welded joints to be completed as follows:
 - .1 Coating of welded joints in the field to be done in accordance with AWWA C210, Section 3.5. Primer and field coating of bare surfaces to be the same materials as used for shop coating of pipe.
- .3 If damage of the coating occurs in the field, repair damaged portions in accordance with AWWA C210, Section 3.4.

3.12 PRESSURE TESTING

- .1 Pressure test completed sections of pipe to 1050 kPa.

3.13 PROPOSED WELDING PROCEDURE

DATE:

JOB TITLE:

AE PROJECT NO.:

CLASSIFICATION OF PIPE

MAXIMUM TENSILE STRENGTH

MAXIMUM YIELD STRENGTH

PERCENTAGE ELONGATION IN 50 mm

MILL TEST FORWARDED TO ASSOCIATED ENGINEERING (YES/NO)

LADLE ANALYSIS FORWARDED TO ASSOCIATED ENGINEERING (YES/NO)

CARBON CONTENT

CARBON EQUIVALENT

EXTERNAL COATING

INTERNAL COATING

PROCESS

DIAMETER AND WALL THICKNESS

JOINT DESIGN

FILLER METAL

Pass	Size	AWS Classification	Voltage	Amperage	Polarity	Brand
1						
2						
3						
4						
5						

POSITION

DIRECTION OF WELDING

NUMBER OF WELDERS

TIME LAPSE BETWEEN PASSES

INTER-PASS HEATING (IF REQUIRED)

METHOD OF HEATING

CLEANING BETWEEN PASSES

PREHEAT

MINIMUM AMBIENT TEMPERATURE

END OF SECTION

APPENDIX A – PROCESS CONTROL NARRATIVE



Associated
Engineering

GLOBAL PERSPECTIVE.
LOCAL FOCUS.

REPORT

Town of Outlook Water Treatment Plant Upgrades Process Control Narrative



MAY 2026



Platinum
member

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1 WATER TREATMENT PLANT

1.1 Raw Water System

1.1.1 Process description

The raw water source for the Town of Outlook (the Town)'s water treatment plant (WTP) is the South Saskatchewan River. The raw water intake and pump station is located 700 m west of the WTP. The surface water supply infrastructure consists of a 600 mm screened pipeline connected to an intake wet well below a pumphouse.

The existing raw water pumping station houses two 60 HP raw water supply pumps (RWP-100-A/B) that pump into a 200 mm diameter header which transitions to a 400 mm raw water supply line. The raw water main connecting the raw water pump station to the WTP is a 700 m long, 400 mm diameter HPDE pipeline which reduces to 300 mm outside the WTP and further reduces to 250 mm prior to entering the WTP. There is an existing manual gate valve outside on the 300 mm line to isolate the raw water supply line.

When the treated water level in the exterior reservoir at the WTP drops below the operator's adjustable fill level set point, the raw water flow valve located in the WTP is opened, and a signal is sent from the WTP to the RWPH via cellular to start a raw water pump. When the treated water level reaches an operator adjustable stop level set point, the treatment equipment and raw water supply pump will shutdown. A top up button on the HMI will allow the operator to start the process even if the level is not below the fill level set point.

The Raw Water Pumphouse has two 60 HP raw water pumps. The raw water pumps are equipped with local hand-off auto switches on their starter panels. Each raw water pump is sized to supply the maximum day raw water flow to the WTP. The two raw water pumps (RWP-100-A and RWP-100-B) operate in a duty/standby configuration. The duty raw water pump alternates when it becomes unavailable, an operator initiates an alternation via the HMI, or when both pumps shutdown. The lead pump won't alternate if the lag pump isn't available. When a piece of equipment has an alarm (fail to start, not in auto, etc.) it becomes unavailable for the automation sequence.

The RWPH is equipped with a level transmitter that monitors the depth of the water in the pump well. The pump well level is sent to the WTP via the cellular connection and is displayed on the HMI. Alarms are triggered on the HMI for high level, low level, and low-low level. A local display on the level transmitter is also available in the RWPH for the operators to view.

The RWPH is equipped with an exterior strobe light for alarming. The strobe light is activated by a signal from the PLC when the high-water level alarm (LIT-200) is active to provide a visual alert. The strobe must be reset manually via a reset button on the strobe light control box, allowing operators to deactivate the alarm after addressing the condition.

The 250 mm raw water line enters the water treatment plant through the floor at the northeast side of the building. This line reduces to 150 mm and has a manual butterfly valve for isolation. There is an existing turbidimeter (AIT-102) used for monitoring the raw water turbidity. There is a new raw water flow control valve (FCV-103) to control the incoming flow to the water treatment plant from the raw water supply system. This valve controls the flow rate to match a predetermined flow rate set point determined by how many filters are in service. The raw water flow control valve will alter the incoming flow rate using a margin of error to maintain an operator adjustable filter level set point. The flow switch on the raw water header confirms raw water flow to start the treatment system and ClearPAC® chemical system for chemical coagulation. A magnetic flow meter (FIT-105) is installed downstream of the flow switch and is used for flow measurement and totalization. Downstream of the flow meter, the line expands to 250 mm prior to chemical injection.

Butterfly valves (BUV-106/107/108) are manually actuated to direct water into selected flocculators or bypass flocculation altogether.

1.1.2 Pump Control Valves

The raw water pumps are each equipped with a deep well pump control valve (PCV-101-A and PCV-101-B). Each deep well pump control valve is hydraulically actuated upon energization of a solenoid pilot valve (SV-101-A and SV-101-B). The valves protect pipelines from surges caused during the startup and shutdown of each of the pumps. Each pump has a dedicated control valve with a bypass line that discharges to the pump well below. The control valves have two positions: an open valve recirculates the pumped water back to the pump well, and a closed valve routes pumped water to the raw water supply line. The valves are equipped with limit switches, which are wired to the pump control circuits for pump shutdowns. The limit switches are monitored by the PLC.

The control valves operation is as follows:

Pump Startup

1. Both raw water pumps are initially off, and the control valves are open (recirculating). When the pump starts, the solenoid pilot valve for the pump's control valve is energized and the valve begins to close slowly. The slow close allows for air and water to be discharged through the bypass line preventing sudden pressure surges from pump startup.
2. During the valve closure, the flow through the bypass line is diminished, and more flow is diverted into the raw water pump house header, into the raw water line leading into the WTP.
3. After the valve is fully closed, all the flow is directed to the WTP. The valve's limit switch is engaged.

Pump Shutdown

1. When the WTP's reservoir reaches the high level setpoint, the call for raw water is deactivated and the solenoid is de-energized. The pump continues to run as the control valve opens slowly, diverting flow from the WTP into the bypass line to the pump well chamber below.
2. The line pressure drops as the control valve is opened, resulting in the simultaneous slow closure of the check valve. Once the control valve is fully open, the valve's limit switch is disengaged and the pump stops. The control valve remains open to release any air and water pressure in the line as the pump shuts down, and the check valve remains closed protecting the rest of the system.

Typically, closure times are chosen based on a value of 5-10 times the characteristic time of the system. For this system the characteristic time is 30-60 s. The final closure time is determined during commissioning of the pump control valves.

1.1.3 Major Equipment

- Pump Well Level Transmitter LIT-200
- High Water Alarm Strobe Light YA-972
- Raw Water Pumps RWP-100-A
- Raw Water Pumps RWP-100-B
- Pump Control Valve PCV-101-A
- Pump Control Valve PCV-101-B
- PCV Pilot Solenoid Valve SV-101-A
- PCV Pilot Solenoid Valve SV-101-B
- Raw Water Turbidity Valve BAV-102
- Raw Water Turbidity Meter AIT-102
- Raw Water Flow Control Valve FCV-103
- Raw Water Flow Switch FS-104
- Raw Water Flow Meter FIT-105

1.1.4 Interlocks

- Only one raw water pump is permitted to operate at a time.
- Raw Water Pumps RWP-100-A and RWP-100-B are locked-out when pump well level low-low alarm is active.

1.1.5 Alarms

• Wet Well Level LIT-200 Signal Out of Range	• Raw Water Pump RWP-100-B Failed to Start
• Wet Well Level LIT-200 High	• Raw Water Pump RWP-100-B Failed to Stop
• Wet Well Level LIT-200 Low	• Raw Water Pump RWP-100-B No Flow
• Wet Well Level LIT-200 Low Low	• Raw Water Turbidity Transmitter AIT-102 Out of Range
• Raw Water Pump RWP-100-A Not in Auto	• Raw Water Turbidity AIT-102 High
• Raw Water Pump RWP-100-A Fault	• Raw Water Flow Transmitter FIT-105 Out of Range
• Raw Water Pump RWP-100-A Failed to Start	• Raw Water Flow Transmitter FIT-105 High
• Raw Water Pump RWP-100-A Failed to Stop	• Raw Water Flow Transmitter FIT-105 Low
• Raw Water Pump RWP-100-A No Flow	
• Raw Water Pump RWP-100-B Not in Auto	
• Raw Water Pump RWP-100-B Fault	

1.1.6 Operating Setpoints

Adjustable Setpoints	Value	Range	Units
Stop Raw Water Pumps Water Level		0-0.5	m
Exterior Reservoir Level to Start RW Pumps	TBD	TBD	mm
Exterior Reservoir Level to Stop RW Pumps	TBD	TBD	mm

1.1.7 Alarm Setpoints

Adjustable Setpoints	Value	Range	Units
Raw Water Turbidity High	TBD	TBD	NTU
Raw Water Flow High	TBD	TBD	L/s
Raw Water Flow Low	TBD	TBD	L/s
Wet Well Level LIT-200 High	4	0-5	m
Wet Well Level LIT-200 Low	1.5	0-5	m
Wet Well Level LIT-200 Low-Low	.9	0-5	m

1.2 Raw Water Pumphouse Building Monitoring

The RWPH is equipped with instruments for monitoring the status of the building and surrounding infrastructure. The main valve on the raw water supply line to the WTP is equipped with a leakage detection pipe, which has a vibronic level switch (LSH-200) to alert operators if the valve is experiencing a major leak. The building is also equipped with a temperature transmitter (TIT-201) which is used to view the RWPH temperature from the WTP HMI and to alert operators in the event of a heating failure.

All alarms are transmitted to the WTP where they are displayed on the HMI for operator acknowledgment.

1.2.1 Major Equipment

- Leak Detection Level Switch LSH-200.
- RWPH Temperature Transmitter TIT-201.

1.2.2 Interlocks

- N/A.

1.2.3 Alarms

- Leak Detection Level Switch LSH-200 Leak Detected.
- Raw Water Pumphouse Low Temperature TIT-201.

1.2.4 Operating Set Points

- N/A.

1.2.5 Alarm Setpoints

Adjustable Setpoints	Value	Range	Units
RWPH Temperature Low TIT-201	5	0-15	°C

1.3 Pre-treatment System

1.3.1 Process Description

The pre-treatment system consists of chemical injection and three-stage flocculation, which operate in series via gravity. The 250 mm line downstream of the flow meter contains three chemical injection points. One for each of the ClearPAC® 182, Polymer and chlorine solutions (polymer and chlorine not currently injected into raw water but has the capability). ClearPAC® 182 is injected as a coagulant into the system once the flow is confirmed through the flow switch (FS-104) at an operator-adjustable feed rate; the ClearPAC® 182 is not flow-paced. The other two injection points are not currently in service but shall have provisions for future use. A static mixer is installed downstream of chemical injection points to promote chemical mixing. The treatment system has an overall capacity of 53 L/s.

Chemical-treated water discharges into the bottom of the first flocculator (FLOC-300) and overflows into the second (FLOC-301) and third (FLOC-302) flocculators in series. Each flocculation tank is equipped with a constant speed mixer to promote collisions between the particles and coagulant to form the larger, heavier floc that can be settled. The flocculator system has its own control panel located next to the treatment system with hand-off auto switches for the mixers in the tanks. The Town has optimized the flocculation pre-treatment system and currently runs the mixer in Flocculator No. 2 only. Once pre-treated, water then collects in a trough and flows to the downstream filter by gravity.

Sludge will continuously collect in the bottom of the flocculator tanks which will require periodic sludge blowdowns at intervals determined by the Operator. During the time of a sludge blowdown the tanks must either be bypassed, or the system is to be shutdown.

2 CHEMICAL SYSTEMS

2.1 ClearPAC® 182

The ClearPAC® 182 chemical pump is located next to the flocculator tanks. ClearPAC® 182 is injected as the coagulant into the 250 mm inline static mixer on the raw water line prior to entering the flocculator system. The ClearPAC® 182 is signalled to operate via the flow switch (FS-104), confirming flow on the raw water header. The ClearPAC® system is not flow paced, and the feed rate is manually set by the Operator.

2.2 Polymer (not currently used)

Polymer is also injected as the coagulant into the 250 mm inline static mixer. There is currently no chemical pump for the polymer system, although it may be used again in the future. The chemicals at the water treatment plant are not flow-paced and the feed rate is manually set by the operator.

2.3 Gas Chlorination

Chlorine gas is used to provide a free chlorine residual for disinfection, and all chlorination equipment are located in a dedicated chlorine gas room in the water treatment plant. The injection points include raw water header (not in use), directly into the filters (not in use), the discharge of the filter effluent booster pumps (BTP-342-A/B) and directly into the clearwell. Under normal operation, a chlorine solution is injected into the filter effluent booster pump discharge line. The Operator will also be able to dose chlorine directly into the Clearwell if the free chlorine residuals in the clearwell are low with the use of manual valves.

In the event that there is a low free chlorine alarm for the distribution header then the operator will need to adjust the manual feed valves to add chlorine to clearwell as indicated above.

2.4 Fluoride

The fluoride system is located in the chemical feed room next to the electrical/storage room. The fluoride is injected directly into the clearwell and is signalled to operate via the flow switch (FS-104), confirming flow on the raw water header. The fluoride system is not flow-paced, and the chemical feed rate is manually set by the operator.

3 FILTRATION SYSTEM

3.1 Process Description

The pre-treated water collects and exits the third flocculation tank (FLOC-302) via a 300 mm diameter line to the 300 mm filter supply header. Water from the filter influent header will be distributed into individual filter inlet piping, which discharge into filter trough and distribute into the filter bed. Under normal operation conditions, both filters (FLT-310-A/B) are hydraulically connected and operate at the same water level. The filtration system includes two gravity filters, and each consists of 300 mm anthracite, 300 mm sand media, 230 mm support gravel and an underdrain system. There is a provision for chlorine solution injection at the common filter influent header to disinfect the filter if required, although it is currently disconnected.

The manual influent filter valves (BUV-310-A/B) will remain open if the filter is in service and will only be closed for backwashes or when a filter is removed from service. Water from the pre-treatment system will be hydraulically split to flow into the gravity sand filters through the two layers of media aiding in removing the large floc. When a filter is not in service because of alarms or is disabled by the operator via the HMI, its influent valve will remain closed.

Town of Outlook
Water Treatment Plant Upgrades
Process Control Narrative

Filtered water is collected by each lateral of the underdrain system and enters a treated water collection flume. The flume discharges into two individual 250 mm filter effluent pipes, which discharge into a common 300 mm filter effluent collection header. From the effluent header, the filtered water will either automatically flow through the filter to the waste valve (FCV-330) or to the filter effluent booster pumps (BTP-342-A/B) and the common filter effluent valve (BUV-347), depending on the active process sequence listed below. When the filter to waste valve is opened, the common filter effluent valve (BUV-347) will be closed.

The filter effluent booster pumps (BTP-342-A/B) operate in a duty/standby configuration, and both are equipped with VFDs. The duty pump is started when the filtration system is called to run, and the filter-to-waste system is not in service. The speed of the pump shall be controlled by a PID loop to maintain a constant flow rate set point determined by how many filters are in service measured with by the filter effluent flow meter (FIT-340). The pumps shall operate in an alternating mode, changing which is the duty pump each time the filtering process is started, the duty pump faults, or if an operator initiates an alternation via the HMI. When both filters are in operation, level control shall be based on a single transmitter (LIT-310-B), and the other shall be a backup.

The discharge line from filter effluent booster pumps is configured to allow treated water to be discharged into either the exterior reservoir, the WTP adjacent reservoir, or the WTP Clearwell. To accomplish this, operations will configure manual valves to direct the flow. Under normal operation, water will flow from the filters through the booster pumps to the large exterior reservoir. From the large exterior reservoir, water will flow through the WTP adjacent reservoir and into the Clearwell. Manual isolation valves are provided on each of the lines to direct flow from the booster pumps in case one of the reservoirs needs to be taken out of service. When the exterior reservoir is in service, a level transmitter (LIT-400-A) is used to determine when to start making water. When this reservoir is taken out of service and filter effluent is directed to the existing WTP reservoir B, level transmitter (LIT-400-B) should be used to determine when to start/stop making water. Should the exterior reservoir be in service, but its level transmitter (LIT-400-A) is out of range, use LIT-400-B for control. Which level transmitter is used for starting the plant will be selected by the operator via the HMI by enabling or disabling a reservoir.

On-line turbidimeters (AIT-312-A/B), complete with solenoid valves (SV-312-A/B), are located on each of the 250 mm filter effluent lines to measure the turbidity of the filtered water from each filter. When the filters are treating water, the solenoid valves open to allow flow to the turbidimeters; when the filters are off, the solenoid valves close to prevent the filters from draining. High turbidity will be used to indicate to the operator that a backwash is required. After a backwash, the filters will go into a Filter-to-Waste mode before allowing filtered water back into the distribution reservoir. During this mode, both filters will drain into the wastewater tank until turbidity is lower than the setpoint (operator adjustable), then FCV-330 will close, and BUV-347 will open, allowing treated water to go to the reservoir.

The position of filter valves and equipment under each operation mode are listed in the following. The equipment is as follows in the table:

• RWP-100-A/B – Raw Water Pump.	• BUV-321-A/B – Manual Backwash Supply Valve.
• BUV-310-A/B – Manual Filter Influent Valves.	• BUV-360-A/B – Manual Air Scour Valve.
• BUV-311-A/B – Manual Filter Effluent Valves.	• Existing Air Scour Blower.
• BUV-347 – Common Filter Effluent Valve.	• BSP-320 – Backwash Pump.
• FCV-330 – Filter to Waste Valve.	• BTP-342-A/B – Filter Effluent Pumps
• .	

Town of Outlook
Water Treatment Plant Upgrades
Process Control Narrative

Table 3-1 Position of filter valves and equipment

Operation	RWP-100-A/B	BUV-310-A/B	BUV-311-A/B	BUV-347	FCV-330	BUV-321-A/B	BUV-360-A/B	Air Scour Blower	BSP-320	BTP-342-A/B
Idle	Off	Open	Closed	Closed	Closed	Closed	Closed	Off	Off	Off
Filtration	On	Open	Open	Open	Closed	Closed	Closed	Off	Off	On
Filter Drain Down	Off	Closed	Open	Closed	Open	Closed	Closed	Off	Off	Off
Air Scour	Off	Closed	Closed	Closed	Closed	Closed	Open	On	Off	Off
Low-rate Backwash and Air Scour (Filter Refill)	Off	Closed	Closed	Closed	Closed	Open	Open	On	On	Off
High-rate Backwash	Off	Closed	Closed	Closed	Closed	Open	Closed	Off	On	Off
Filter Rinse to Waste	On	Open	Open	Closed	Open	Closed	Closed	Off	Off	Off

3.1.1 Manual Air Scour and Filter Backwash Instructions

An alarm indication for filter backwash requirement will pop on the HMI if any of the following conditions are met (set points will be refined during commissioning):

- Run time hours expired - filter will continue running.
- Filter run volume of water treated reaches set point: Initially set to xxx m3 (Operator adjustable value), the filter will continue running.
- Filter effluent turbidity reaches the predetermined set point, the filter will shut down, the booster pump shuts down, and the filter to the reservoir valve (BUV-347) will close.

Filter backwashing is completed manually, and below is the recommended procedure for backwash:

- Turn the filter plant off and select 'Backwash Mode' on the HMI (turns selected alarms off)
- Manually close filter influent valves (BUV-310-A/B).
- Drain both filters down to the marks on the sight glass just above the valves.
- Close the common filter effluent valve (BUV-347) that allows the water to pass through to the Clearwell
- Ensure all valves are in the position as described in Table 3-2 for the Air Scour.
- Start the air scour blower.
- Proceed to the north end of the filter and slowly open the blue butterfly valve allowing air into the bottom of the filter to start the air scour process.
- Allow air scour to run for 5-minutes.
- Open the backwash valves (BUV-321-A/B) on the west side of the filter slightly and start the backwash pump to start raising the level of water in the filter bed. This is considered the low-rate backwash. Run at approximately 500 GPM for 20-seconds then increase to 1000 GPM for 20-seconds and then open the valve for 1500 GPM for the rest of the backwash.
- Allow the air to keep running until the water level reaches the high mark on the sight glass. Slowly close the butterfly valve at the north end to shut off the air and then shutdown the air blower. Ensure the butterfly valves are closed before starting or stopping the air scour blower.
- Once the water starts running through the trough start the backwash timing allowing the water to flow for 5-7-minutes to make sure the cloudiness of the backwash water is gone before you start to shut down.
- Close the backwash valves (BUV-321-A/B) to 1000 GPM for approximately 20-seconds then lower to 500 GPM for approximately 20-seconds.
- Repeat the same procedure for the other filter.

3.1.2 Filter to Waste

Following completion of the backwash cycle, the operator selects that the backwash has finished from the HMI. This starts the process of placing the filters back into service. To start, the filter is placed in the Filter-to-Waste cycle. During the Filter-to-Waste cycle, the duty raw water pump (RWP-100-A/B) is be called to run, the manual filter influent valves (BUV-310-A/B) are open, the filter effluent valves (BUV-311-A/B) are open, the filter to waste valve (FCV-330) is opened and modulates to achieve a predetermined filter to waste flow rate setpoint determined by how many filters are in service. During the Filter-to-Waste cycle, the common filter to reservoir valve (BUV-347) will be closed.

The Filter-to-Waste cycle will last for an operator adjustable filter to waste duration setpoint and/or maximum turbidity set point. These adjustable set points should initially be 5-minutes and 0.2 or 0.3 NTU depending on raw water quality and then adjusted as required during commissioning. When waiting for the turbidity to reach the setpoint, both filters must be measuring a turbidity below the setpoint to allow the Filter-to-Waste cycle to complete. During the Filter-to-Waste cycle, the filter effluent is directed to the filter rinse to waste pipe and into the wastewater holding tank. If the level (LIT-331) in the wastewater holding tank triggers a high high-level alarm, a popup and alarm on the HMI will signal to operations that a Filter-to-Waste cycle is not permitted after a backwash and the Filter-to-Waste cycle is locked out. If it is currently running, the Filter-to-Waste cycle will be stopped.

3.1.3 Wastewater Equalization Tank

Process wastewater discharges into the wastewater equalization tank directly through direct piping from the backwash waste sump and the filter to waste line. A level transmitter LIT-331 monitors the water level in the tank. If the level (LIT-331) in the wastewater holding tank triggers a high high-level alarm, a popup and alarm on the HMI will signal to operations that a Filter-to-Waste cycle is not permitted after a backwash and the Filter-to-Waste cycle is locked out. If it is currently running, the Filter-to-Waste cycle will be stopped.

Wastewater from the wastewater tank discharges to the manhole in front of the WTP building by gravity.

The discharge flow rate can be manually adjusted by manually actuating BUV-332. The discharge rate shall be manually set to 5 L/s and shall be set at the time of commissioning.

3.1.4 Major Equipment

- Filter A Influent Valve BUV-310-A.
- Filter A Level Transmitter LIT-310-A.
- Filter A Effluent Butterfly Valve BUV-311-A.
- Filter A Effluent Turbidity Meter AIT-312-A.
- Filter B Influent Valve BUV-310-B.
- Filter B Level Transmitter LIT-310-B.
- Filter B Effluent Butterfly Valve BUV-311-B.
- Wastewater Equalization Release Valve BUV-332.
- Filter B Effluent Turbidity Meter AIT-312-B.
- Filter to Waste Valve FCV-330.
- Waste Tank Level Transmitter LIT-331.
- Filter Effluent Flow Transmitter FIT-340.
- Filter to Reservoir Valve BUV-347.
- Booster Pumps BTP-342-A/B.
- Booster Pump Pressure Transmitter PIT-346.

3.1.5 Interlocks

- Both filters are to be out of service from normal operation when performing a backwash in either filter.
- Filter to reservoir valve is closed and booster pumps are stopped if either filter effluent turbidity is greater than 0.2 or 0.3 NTU (depending on raw water quality) for an operator adjustable time.
- Filter to reservoir valve is closed and booster pumps are stopped if either filter effluent turbidity is greater than 1 NTU.
- Booster pumps can not run if the filter to reservoir valve is not open.
- Filter to waste is not permitted if there is a high high level in the waste tank.
- A filter level high high alarm shuts down the system.

3.1.6 Alarms

- Filter A Level LIT-310-A Out of Range.
- Filter A Level LIT-310-A High High.
- Filter A Level LIT-310-A High.
- Filter A Level LIT-310-A Low.
- Filter B Level LIT-310-B Out of Range.
- Filter B Level LIT-310-B High High.
- Filter B Level LIT-310-B High.
- Filter B Level LIT-310-B Low.
- Filter A Effluent Turbidity AIT-312-A Out of Range.
- Filter A Effluent Turbidity AIT-312-A High.
- Filter A Effluent Turbidity AIT-312-A High High.
- Filter B Effluent Turbidity AIT-312-B Out of Range.
- Filter B Effluent Turbidity AIT-312-B High.
- Filter B Effluent Turbidity AIT-312-B High High.
- Filter to Reservoir Valve BUV-347 Not in Auto.
- Filter to Reservoir Valve BUV-347 Fault.
- Filter to Reservoir Valve BUV-347 Failed to Open.
- Filter to Reservoir Valve BUV-347 Failed to Close.
- Filter Effluent Flow Transmitter FIT-340 Out of Range.
- Filter Effluent Flow FIT-340 Low.
- Filter Effluent Flow FIT-340 High.
- Filter to Waste Valve FCV-330 Not in Auto.
- Filter to Waste Valve FCV-330 Fault.
- Filter to Waste Valve FCV-330 Fail to Achieve Position.
- Filter to Waste Valve FCV-330 Out of Range.
- Waste Tank Level LIT-331 Out of Range.
- Waste Tank Level LIT-331 High High.
- Waste Tank Level LIT-331 High.
- Booster Pump BTP-342-A Not in Auto.
- Booster Pump BTP-342-A Fail to Start.
- Booster Pump BTP-342-A Fail to Stop.
- Booster Pump BTP-342-A Fail to Achieve Speed.
- Booster Pump BTP-342-A Speed Out of Range.
- Booster Pump BTP-342-A Emergency Shutdown.
- Booster Pump BTP-342-B Not in Auto.
- Booster Pump BTP-342-B Fail to Start.
- Booster Pump BTP-342-B Fail to Stop.
- Booster Pump BTP-342-B Fail to Achieve Speed.
- Booster Pump BTP-342-B Speed Out of Range.
- Booster Pump BTP-342-B Emergency Shutdown.
- Booster Pump Pressure Transmitter PIT-346 Out of Range.
- Booster Pump Pressure PIT-346 High.
- Booster Pump Pressure PIT-346 Low.

3.1.7 Operating Setpoints

Adjustable Setpoints	Value	Range	Units
Hour of Day to Initiate Alternation of Duty/Standby RW Pump	0	0-23	Hour
Exterior Reservoir Level to Start RW Pumps	TBD	TBD	TBD
Exterior Reservoir Level to Stop RW Pumps	TBD	TBD	TBD
WTP Adjacent Reservoir Level to Start RW Pumps	TBD	TBD	TBD
WTP Adjacent Reservoir Level to Stop RW Pumps	TBD	TBD	TBD
Filter Runtime to Call for Backwash	TBD	TBD	Hours
Volume of Water Treated to Call for Backwash	TBD	TBD	TBD
Filter Level to Maintain	TBD	TBD	TBD
Filter to Reservoir Flow to Initialize Filter Effluent Control	TBD	TBD	L/s

Adjustable Setpoints	Value	Range	Units
Filter Turbidity 0.2 or 0.3 NTU Time to Initiate Filter Backwash Alarm	TBD	TBD	Min
Filter Turbidity to End Filter to Waste and Start Filter to Reservoir	TBD	TBD	NTU
Filter to Waste Flow	TBD	TBD	L/s

3.1.8 Alarm Setpoints

Adjustable Setpoints	Value	Range	Units
Filter A Level High	TBD	TBD	TBD
Filter A Level High high	TBD	TBD	TBD
Filter A Level Low	TBD	TBD	TBD
Filter B Level High	TBD	TBD	TBD
Filter B Level High High	TBD	TBD	TBD
Filter B Level Low	TBD	TBD	TBD
Filter A Effluent Turbidity High	TBD	TBD	NTU
Filter A Effluent Turbidity High high	TBD	TBD	NTU
Filter B Effluent Turbidity High	TBD	TBD	NTU
Filter B Effluent Turbidity High High	TBD	TBD	NTU
Filter to Reservoir Flow High	TBD	TBD	L/s
Waste Tank Level High High	TBD	TBD	TBD
Waste Tank Level High	TBD	TBD	TBD
Booster Pump Pressure High	TBD	TBD	TBD
Booster Pump Pressure Low	TBD	TBD	TBD

4 DISINFECTION AND RESERVOIR TRANSFER

The filter effluent booster pumps (BTP-343-A/B) transfer treated water to the exterior treated water storage reservoir and water flows back to the WTP adjacent reservoir by gravity. Chlorine solution is injected into the common discharge header before the filter effluent booster pumps at a constant dose for primary disinfection when one of the filter effluent booster pump are on and BUV-347 is open. The exterior reservoir provides sufficient contact time on a continuous basis to ensure greater or equal to 4-log reduction of virus and 0.5 log reduction of giardia. Free chlorine levels are analyzed by the chlorine analyzer (AIT-348) on the discharge header from the filter effluent booster pumps.

The WTP adjacent reservoir is connected to the clearwell through an interconnection valve vault. The level control valve (LCV-407) in the valve vault will be normally open and closes upon high level alarm from LIT-413 or LSH-413. A level control valve (LCV-410) will open to allow water flow from the adjacent reservoir back into pump well when the clearwell water level drops below the operator adjustable clearwell fill set point. The valve will stay open till it reaches the operator adjustable clearwell full level. A top up button on the HMI will allow the operator to start the process if the low level hasn't been reached yet to fill the clear well. There is also a manual bypass line located in the valve vault to allow flow through in the event that LCV-407 is out of service. When the clearwell level is manually controlled, high level setpoints in both reservoirs must be operator adjusted to match the level in the pump well to prevent the basement from flooding.

4.1.1 Major Equipment

- Booster Pumps BTP-342-A/B.
- Reservoir Influent Chlorine Analyzer AIT-348.
- Reservoir Fill Valve BUV-347.
- Clearwell Fill Level Control Valve LCV-407.
- Clearwell Fill Level Control Valve LCV-410.

4.1.2 Interlocks

- N/A.

4.1.3 Alarms

- Booster Pump BTP-342-A Not in Auto.
- Booster Pump BTP-342-A Fault.
- Booster Pump BTP-342-A Fail to Start.
- Booster Pump BTP-342-A Fail to Stop.
- Booster Pump BTP-342-A Fail to Achieve Speed.
- Booster Pump BTP-342-A Speed Out of Range.
- Booster Pump BTP-342-A Emergency Shutdown.
- Booster Pump BTP-342-B Not in Auto.
- Booster Pump BTP-342-B Fault.
- Booster Pump BTP-342-B Fail to Start.
- Booster Pump BTP-342-B Fail to Stop.
- Booster Pump BTP-342-B Fail to Achieve Speed.
- Booster Pump BTP-342-B Speed Out of Range.
- Booster Pump BTP-342-B Emergency Shutdown.
- Reservoir Influent Chlorine Analyzer AIT-348 Out of Range.
- Reservoir Influent Chlorine AIT-348 High.
- Reservoir Influent Chlorine AIT-348 Low.
- Reservoir Fill Valve BUV-347 Not in Auto.
- Reservoir Fill Valve BUV-347 Fault.
- Reservoir Fill Valve BUV-347 Fail to Open.
- Reservoir Fill Valve BUV-347 Fail to Close.
- Clearwell Fill Level Control Valve LCV-407 Not in Auto.
- Clearwell Fill Level Control Valve LCV-407 Fault.
- Clearwell Fill Level Control Valve LCV-407 Out of Range.

- Clearwell Fill Level Control Valve LCV-407 Fail to Achieve Position.

4.1.4 Operating Setpoints

Adjustable Setpoints	Value	Range	Units
Clearwell Level to Start Fill From Reservoirs	TBD	TBD	TBD
Clearwell Level to Stop Fill From Reservoirs	TBD	TBD	TBD
Flow to Fill From Reservoirs	TBD	TBD	L/s

4.1.5 Alarm Setpoints

Adjustable Setpoints	Value	Range	Units
Booster Pump Effluent Flow High	TBD	TBD	TBD
Booster Pump Effluent Flow Low	TBD	TBD	TBD
Reservoir Influent Chlorine High	TBD	TBD	TBD
Reservoir Influent Chlorine Low	TBD	TBD	TBD

5 DISTRIBUTION PUMPING

There are three distribution pumps (DP-420-A/B/C) all the same size controlled by VFD to maintain an operator adjustable distribution pressure (PIT-424) set point. The pumps run in a three staged operation. Stage one will always be active if any of the distribution pumps are available and the water level in the reservoir is not below operator adjustable low low level (LIT-413). If the water drops below the low low level set point, the distribution pumps will be locked out. They will be re-enabled once the level increases above a hard coded distribution enable set point. If LIT-413 is out of service, low-level float (LSL-413) will be used in place of the low low setpoint.

If the Stage 1 pump is running at 58 Hz for a predetermined amount of time or the distribution pressure is below the operator adjustable distribution pressure set point, then the stage 2 pump will start. The two pumps will run at the same speed in lockstep to maintain pressure. The process will be repeated for stage 3 if required after a time delay to allow the system to settle.

If the pump speed is below 32 Hz for a predetermined amount of time or the distribution flow is below an operator adjustable distribution flow set point, then the stage 3 pump will shutdown and the other two will continue to run. This process will be repeated if required until only stage 1 is active.

The stage 1/2/3 pumps will be alternated once a day at an operator adjustable time of day. If distribution pump DP-420-A was the lead, then DP-420-B would now be the lead and so on. The Stage 1 pump will also alternate if the stage 1 pump fails, all the pumps are shutdown, or the operator initiates a pump alternation from the HMI. DP-420-A is the only pump that can run on backup power, so it will be Stage 1 if the plant is running on backup power.

The Town has an emergency engine driven standby pump which is operated manually in the event of power outages and high-water usage. The Town manually starts the engine driven standby pump if demands exceed the capability of DP-420-A which is backed up by the generator.

The truckfill is fed from the distribution header. A solenoid drain valve (SV-442) is normally open to drain the truckfill line when not in use. If the truckfill is called for and the flow switch (FS-441) is energized, the drain valve is closed.

5.1.1 Major Equipment

- Clearwell Level Transmitter LIT-413.
- Clearwell Level Switch LSH-413.
- Clearwell Level Switch LSL-413.
- Distribution Pumps DP-420-A/B/C.
- Distribution Free Chlorine Transmitter AIT-421.
- Distribution Turbidity Transmitter AIT-422.
- Distribution Flow Transmitter FIT-423.
- Standby Distribution Pump SDP-430.
- Truckfill Drain Valve SV-442.

5.1.2 Interlocks

- If the level in the clearwell triggers a low low level alarm, lock-out the distribution pumps.
- When running on standby power distribution pumps DP-420-B and DP-420-C will be locked out.

5.1.3 Alarms

- Clearwell Level Transmitter LIT-413 Out of Range.
- Clearwell Level LIT-413 High High.
- Clearwell Level LIT-413 High.
- Clearwell Level LIT-413 Low.
- Clearwell Level LIT-413 Low Low.
- Clearwell Level Switch LSH-413 High.
- Clearwell Level Switch LSL-413 Low.
- Distribution Pump DP-420-A Not in Auto.
- Distribution Pump DP-420-A Fault.
- Distribution Pump DP-420-A Fail to Start.
- Distribution Pump DP-420-A Fail to Stop.
- Distribution Pump DP-420-A Fail to Achieve Speed.
- Distribution Pump DP-420-A Speed Out of Range.
- Distribution Pump DP-420-A Emergency Shutdown.
- Distribution Pump DP-420-B Not in Auto.
- Distribution Pump DP-420-B Fault.
- Distribution Pump DP-420-B Fail to Start.
- Distribution Pump DP-420-B Fail to Stop.
- Distribution Pump DP-420-B Fail to Achieve Speed.
- Distribution Pump DP-420-B Speed Out of Range.
- Distribution Pump DP-420-B Emergency Shutdown.
- Distribution Pump DP-420-C Not in Auto.
- Distribution Pump DP-420-C Fault.
- Distribution Pump DP-420-C Fail to Start.
- Distribution Pump DP-420-C Fail to Stop.
- Distribution Pump DP-420-C Fail to Achieve Speed.
- Distribution Pump DP-420-C Speed Out of Range.
- Distribution Pump DP-420-C Emergency Shutdown.
- Distribution Free Chlorine Transmitter AIT-421 Out of Range.
- Distribution Free Chlorine AIT-421 High.
- Distribution Free Chlorine AIT-421 Low.
- Distribution Turbidity Transmitter AIT-422 Out of Range.
- Distribution Turbidity AIT-422 High.
- Distribution Turbidity AIT-422 High High.
- Distribution Flow Transmitter FIT-423 Out of Range.
- Distribution Flow FIT-423 Low.
- Distribution Flow FIT-423 High.

- Distribution Pressure PIT-424 High.
- Distribution Pressure PIT-424 Low.

5.1.4 Operating Setpoints

Adjustable Setpoints	Value	Range	Units
Clearwell Level Pumps Enable	TBD	TBD	TBD
Distribution Pressure	57	TBD	PSI
Distribution Flow Stage Down	TBD	TBD	TBD

5.1.5 Alarm Setpoints

Adjustable Setpoints	Value	Range	Units
Clearwell Level High	TBD	TBD	TBD
Clearwell Level Low	TBD	TBD	TBD
Clearwell Level Low Low	TBD	TBD	TBD
Distribution Free Chlorine Low	TBD	TBD	mg/L
Distribution Free Chlorine High	TBD	TBD	mg/L
Distribution Pressure High	TBD	TBD	PSI
Distribution Pressure Low	TBD	TBD	PSI
Distribution Flow High	TBD	TBD	L/s
Distribution Flow Low	TBD	TBD	L/s

6 MISCELLANEOUS

6.1 Process Description

6.1.1 Standby Power

The generator GEN-920 will provide standby power to the plant when called to run by the automatic transfer switch ATS-921. The ATS and generator will provide status for monitoring and alarming purposes. When operating on standby power filtration processes, building services, and plant monitoring will operate normally. Distribution pumping will be limited to DP-420-A while on standby power.

6.1.2 Flood Protection

Flood switches located in the process area (LSH-950) and valve vault (LSH-951) will trigger alarms in the event of a burst pipe or clearwater well overflow.

6.1.3 Major Equipment

- Process Area Flood Switch LSH-950.
- Valve Vault Flood Switch LSH-951.
- Generator GEN-920.
- Generator Room Carbon Monoxide Detector AIT-961.
- Automatic Transfer Switch ATS-921.
- Surge Protection Device SPD-922.

6.1.4 Interlocks

- N/A.

6.1.5 Alarms

- Process Area Flooded LSH-950.
- Generator GEN-920 Not in Auto.
- Generator GEN-920 Fault.
- Generator GEN-920 Warning.
- Generator GEN-920 Fail to Start.
- Generator Room Carbon Monoxide Detector AIT-961 Out of Range.
- Generator Room Carbon Monoxide AIT-961 High.
- Generator Room Carbon Monoxide AIT-961 High High.
- Auto Transfer Switch ATS-921 Not in Auto.
- Auto Transfer Switch ATS-921 Fault.
- Auto Transfer Switch ATS-921 On Generator.
- Auto Transfer Switch ATS-921 Utility Not Available.
- Auto Transfer Switch ATS-921 Generator Not Available.
- Surge Protection Device SPD-922 Fault.

6.1.6 Operating Setpoints

- N/A.

6.1.7 Alarm Setpoints

Adjustable Setpoints	Value	Range	Units
Generator Room Carbon Monoxide High	TBD	TBD	TBD
Generator Room Carbon Monoxide High High	TBD	TBD	TBD

7 CONTROL SYSTEM

7.1 Water Treatment Plant Control Panel

7.1.1 Process Description

The WTP will be equipped with an Allen-Bradley CompactLogix PLC for the operator to interface with the control system. System process control logic for the process equipment at the WTP will be completed by one PLC located in the plant control panel.

All set points used for system control will be values input by the operator through a set point table, with an allowable PLC hard programmed set point range. Each set point will have a hard programmed range based on the minimum and maximum range of its associated sensor. For Example, LIT-400-A (Level transmitter in Reservoir A) can read up to a maximum depth of 10 m. Therefore, all set points for this sensor must fall within the range of 0 m to 10 m.

All process variables (inputs) and control variables (outputs) will be scaled based on the actual operating and calibration ranges tested and confirmed for each piece of equipment.

The PLC monitors the fault status of equipment in the control panel such as: the uninterruptible power supplies (UPS-930 and UPS-931) and controls power supplies (PS-930-A/B and PS-931-A/B). Other plant services monitored include the fault status of the surge protection device (SPD-922) and floor flood switches provide indication of a broken pipe or joint.

An alarm will be activated when a defined equipment failure, equipment fault, or operator defined Set Point is reached. All alarms are programmed with a suitable time delay to prevent nuisance alarms, time delays for all alarms are operator adjustable via the HMI. Specific alarms are listed and defined in relevant sections of the process control narrative. Alarms are divided into two groups: critical and minor.

Critical alarms will become latched, to reset a latched alarm the alarm condition must no longer exist and then the user must press the alarm acknowledge button on the HMI. A minor alarm condition will be cleared by the PLC once the alarm condition no longer exists then the operation will be restored by the PLC. The operator will be notified of alarms via in the alarm banner on the HMI for all alarms.

Historic alarms can be viewed on the alarm's history page, even after an alarm has been cleared off the main alarm banner, it can still be viewed on the alarm history page. Operator will see different colors on the alarm history page, each with different meaning:

- Red – Alarm condition and unacknowledged.
- Black – Alarm condition and acknowledged.
- Green – No longer in alarm condition and unacknowledged.

7.1.1 Major Equipment

- Uninterruptable Power Supply UPS-930.
- Uninterruptable Power Supply UPS-931.
- Power Filter PF-930.
- Power Filter PF-931.
- DC Power Supply PS-930-A and PS-930-B.
- DC Power Supply PS-931-A and PS-931-B.
- Ethernet Switch ES-930.
- Ethernet Switch ES-931.

7.1.2 Interlocks

- N/A.

7.1.3 Alarms

- Uninterruptable Power Supply UPS-930 Mains Failed.
- Uninterruptable Power Supply UPS-930 Fault.
- Uninterruptable Power Supply UPS-931 Mains Failed.
- Uninterruptable Power Supply UPS-931 Fault.
- Power Filter PF-930 Fault.
- Power Filter PF-931 Fault.
- DC Power Supply PS-930-A Fault.
- DC Power Supply PS-930-B Fault.
- DC Power Supply PS-931-A Fault.
- DC Power Supply PS-931-B Fault.
- Ethernet Switch ES-930 Major Fault.
- Ethernet Switch ES-930 Minor Fault.
- Ethernet Switch ES-931 Major Fault.
- Ethernet Switch ES-931 Minor Fault.

7.2 RWPH Control Panel

7.2.1 Process Description

System process control logic for the process equipment at the RWPH is completed by one PLC located in the area control panel (ACP-970). The PLC at the RWPH communicates with the PLC at the WTP HMI. In general, alarms from the RWPH are transmitted to the PLC at the WTP. From the HMI located in the WTP, operators can also adjust setpoints for the RWPH

All set points used for system control are values input by the operator through a set point table, with an allowable PLC hard programmed set point range. Each set point has a hard programmed range based on the minimum and maximum operating range of its associated sensor.

All process variables (inputs) and control variables (outputs) will be scaled based on the actual operating and calibration ranges tested and confirmed for each piece of equipment.

The PLC monitors the fault status of equipment in the control panel such as the uninterruptible power supplies (UPS-970) and controls power supplies (PS-970-A/B), power filter (PF-970), and ethernet switch (ES-970).

An alarm is activated when a defined equipment failure, equipment fault, or operator defined set point is reached. All alarms are programmed with a suitable time delay to prevent nuisance alarms, time delays for all alarms are operator adjustable via the HMI at the WTP. Specific alarms are listed and define in relevant sections of the process control narrative. Alarms are divided into two groups: critical and minor.

Critical alarms become latched upon activation, to reset a latched alarm the alarm condition must no longer exist, and the user must press the alarm acknowledge button on the HMI. A minor alarm condition is cleared by the PLC once the alarm condition no longer exists then the normal operation is restored by the PLC. The operator is notified of alarms via the alarm banner on the HMI for all alarms.

Historic alarms can be viewed on the alarm's history page, even after an alarm has been cleared off the main alarm banner, it can still be viewed on the alarm history page. Operator can see different colors on the alarm history page, each with different meaning:

- Red – Alarm condition and unacknowledged.
- Black – Alarm condition and acknowledged.
- Green – No longer in alarm condition and unacknowledged.

7.2.2 Major Equipment

- Uninterruptable Power Supply UPS-971.
- Power Filter PF-970.
- DC Power Supply PS-970-A and PS-970-B.
- Ethernet Switch ES-970.

7.2.3 Interlocks

- N/A.

7.2.4 Alarms

- Uninterruptable Power Supply UPS-971 Mains Failed.
- Uninterruptable Power Supply UPS-971 Fault.
- Power Filter PF-970 Fault.
- DC Power Supply PS-970-A Fault.
- DC Power Supply PS-970-B Fault.
- Ethernet Switch ES-970 Fault.

8 ALARM DIALER

8.1 Process Description

The WTP will be equipped with a Protalk CV3 alarm dialer (AD-962) to notify operations when a critical condition becomes active. This alarm dialer will send callouts to on-call personnel with up to 10 relevant alarm messages depending on the alarm.

8.2 Alarm Dialer Channels

Channel/DO	Alarm	Alarm Message
Channel 1: Raw Water	Any critical alarm preventing raw water pumping to the plant	TBD
Channel 2: Filter A	Any critical filter alarm that will take filter A out of service	TBD
Channel 3: Filter B	Any critical filter alarm that will take filter B out of service	TBD
Channel 4: Waste	Any alarm on filter to waste valve or high high level on the waste tank	TBD
Channel 5: Booster Pump	Any booster pumping critical alarm	TBD
Channel 6: Reservoirs High	Reservoir level high high of current reservoir or clearwell	TBD
Channel 7: Reservoirs Low	Reservoir level low low of current reservoir or clearwell	TBD
Channel 8: Distribution	No distribution pumps available	TBD
Channel 9: Power	ATS on standby and generator fail to start	TBD
Channel 10: Miscellaneous	Any alarm on flood switches in valve vault or basement pump room	TBD

APPENDIX B – INPUT/OUTPUT LIST

Main Control Panel I/O List															
FIELD DEVICE TAG	I/O TAG	SOURCE	DESTINATION	DEVICE LOCATION	DESCRIPTION	RACK	SLOT	CHANNEL	DI	DO	AI	AO	Comms	Signal Level	Notes
RWP-100-A	HS-100-A	Raw Water Pump A	ACP-970	Main Floor	Auto Status		0	0	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	XA-100-A				Overload		0	1	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	XS-100-A				Run Status		0	2	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	XC-100-A				Run Command		0	0		1				24VDC	Slot 0 indicates built-in IO points onboard Micro850
RWP-100-B	HS-100-B	Raw Water Pump B	ACP-970	Main Floor	Auto Status		0	3	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	XA-100-B				Overload		0	4	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	XS-100-B				Run Status		0	5	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	XC-100-B				Run Command		0	1		1				24VDC	Slot 0 indicates built-in IO points onboard Micro850
LSH-200	LSH-200	Leak Detection Level Switch - High	ACP-970	Lower Level	Leak Detected		0	6	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
TIT-201	TIT-201	Pumphouse Low Temperature Transmitter	ACP-970	Main Floor	Enabled		1	0			1			4-20mA	
LIT-200	LIT-200	Wet Well Level Transmitter	ACP-970	Main Floor	Level		1	1			1			4-20mA	
PCV-101-A	ZSO-101-A	Valve - 2-Position	ACP-970	Main Floor	Open Status		0	9	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	ZSC-101-A				Close Status		0	10	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
PCV-101-B	ZSO-101-B	Valve - 2-Position		Main Floor	Open Status		0	11	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
	ZSC-101-B				Close Status		0	12	1					24VDC	Slot 0 indicates built-in IO points onboard Micro850
SV-101-A	ZCO-101-A	Pump Startup Valve - Solenoid Pilot Valve	ACP-970	Main Floor	Open Command		0	3		1				24VDC	Slot 0 indicates built-in IO points onboard Micro850
SV-101-B	ZCO-101-B	Pump Startup Valve - Solenoid Pilot Valve	ACP-970	Main Floor	Open Command		0	4		1				24VDC	Slot 0 indicates built-in IO points onboard Micro850
ACP-970	XL-970	Control Panel	ACP-970	Main Floor	General Alarm		0	5		1				24VDC	Slot 0 indicates built-in IO points onboard Micro850
	HS-970				Alarm Reset Switch		2	0	1					24VDC	
	XA2-970				Ethernet Switch Fault		2	1	1					24VDC	
	XA3-970				Power Filter Fault		2	2	1					24VDC	
	JA2-970				24VDC Power Supply A Fault		2	3	1					24VDC	
	JA3-970				24VDC Power Supply B Fault		2	4	1					24VDC	
YA-972	YA-972	High Water Alarm Enclosure (Alarm Strobe Light)	ACP-970	High Water Alarm Enclosure (Existing)	Enabled		0	6		1				24VDC	Slot 0 indicates built-in IO points onboard Micro850
UPS-971	JA1-971	Uninterruptible Power Supply	ACP-970	Main Floor	UPS Mains Fail		2	5	1					24VDC	
	XA1-971				UPS Fault		2	6	1					24VDC	

APPENDIX C – COMMISSIONING FORMS

1

EQUIPMENT INSTALLATION CERTIFICATION FORM

Project:

Contract No:

Equipment Tag #:

Drawing Reference:

Specification Section:

Manufacturer:

Model #:

Serial #:

Equipment Description:

The undersigned Vendor of the equipment item described above hereby certifies the equipment item, as specified in the Project Specifications, has been provided and installed in accordance with the manufacturer's recommendations and that the equipment item may be started and field tested.

Comments:

_____ (Vendor)	_____ (Signature of Authorized Representative)	_____ (Date)
_____ (Contractor)	_____ (Signature of Authorized Representative)	_____ (Date)
_____ (Cx Manager)	_____ (Signature of Authorized Representative)	_____ (Date)
_____ (Engineer)	_____ (Signature of Authorized Representative)	_____ (Date)

This document is not to be construed as Substantial Performance or Notice of Acceptance.

1 START-UP CERTIFICATION FORM

Project:

Contract No:

System Name:

List each equipment item included in the System. Attach marked Piping Schematics and/or P&ID indicating specific items and System limits.

Equipment Description	Equipment Tag #	Manufacturer	Model #

The undersigned Contractor hereby certifies that the System has been started, including but not limited to cleaned, flushed, pressure tested, disinfected, loop checked, and that field testing of the System has been successfully completed. The System is made ready for Functional Performance Testing, in accordance with the Project Specifications.

☐

Certified Field Performance Test results attached.

(Contractor)

(Signature of Authorized Representative)

(Date)

(Cx Manager)

(Signature of Authorized Representative)

(Date)

(Engineer)

(Signature of Authorized Representative)

(Date)

This document is not to be construed as Substantial Performance or Notice of Acceptance.

1 FUNCTIONAL PERFORMANCE TESTING CERTIFICATION FORM

Project:

Contract No:

System Name:

System Name and equipment compliment shall match that listed within the respective Start-Up Certification Form.

The undersigned Contractor hereby certifies that the System has successfully completed Functional Performance Testing. The system is made ready for System Verification, in accordance with the Project Specifications.

- ☐ Completed Functional Performance Testing results attached.
- ☐ Training completed for all System equipment, in accordance with the Project Specifications.
- ☐ O&M Manuals submitted and reviewed, in accordance with the Project Specifications.
- ☐ Asset Management deliverables submitted and reviewed, in accordance with the Project Specifications.

(Contractor)

(Signature of Authorized Representative)

(Date)

(Cx Manager)

(Signature of Authorized Representative)

(Date)

(Engineer)

(Signature of Authorized Representative)

(Date)

(Owner)

(Signature of Authorized Representative)

(Date)

This document is not to be construed as Substantial Performance or Notice of Acceptance.

1 SYSTEM VERIFICATION CERTIFICATION FORM

Project:

Contract No:

System Name:

System Name and equipment compliment shall match that listed within the respective Start-Up Certification and Functional Performance Testing Certification Forms.

The undersigned Contractor hereby certifies that the System has successfully completed System Verification, in accordance with the Project Specifications. The System is free from defects and is readied for operation.

☐
☐

Spare parts have been turned over to the Owner, as required by the Project Specifications.

Special tools have been turned over to the Owner, as required by the Project Specifications.

(Contractor)

(Signature of Authorized Representative)

(Date)

(Cx Manager)

(Signature of Authorized Representative)

(Date)

(Engineer)

(Signature of Authorized Representative)

(Date)

(Owner)

(Signature of Authorized Representative)

(Date)

This document is not to be construed as Substantial Performance or Notice of Acceptance.