Regional District of Nanaimo

Whiskey Creek Water Service Area
Production Well Site

Tender No. 21-008
MPE Project No. 9794-003-00

Master Municipal Construction Documents
Platinum Edition Volume II, 2009
Unit Price Contract

Mandatory Pre-Bid Meeting and Site Inspection:
Will begin Tuesday, February 9, 2021 at 10:00 AM, local time
beginning at the Whiskey Creek Pump Station, 979 Poplar Way.

Pre-registration for pre-bid meeting is required.
Submit intent to attend to:
jhardy@mpe.ca

Closing Location: gstpierre@rdn.bc.ca via email

Issue Date: Thursday, January 28, 2021
Closing Date: Thursday, March 4, 2021
on or before 3:00:00 pm, local time

Tender Inquiries
Jill Hardy, P.Eng.
403-219-6319
jhardy@mpe.ca

Regional District of Nanaimo

Whiskey Creek Water Service Area
Production Well Site

Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-28

Kim Schurtz, B.A., Eng.L.
Project Manager
Process

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
C. J. FORSYTH
51135
28 January 2021

Colin Forsyth, M.Eng., P.Eng.
Structural Engineer

Peter Goertzen, P.Eng., LEED A.P.
Electrical Engineer

Prepared by MPE Engineering Ltd.

CONFIDENTIALITY AND © COPYRIGHT

These 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 *Work* 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 expressed 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.

The complete **Unit Price Contract Documents** are based on the **Master Municipal Construction Documents (MMCD)** and consist of the following parts:

1. Documents provided herein:

- Invitation to Tenderers
- Instructions to Tenderers Part I
- Form of Tender
  - Appendix 1 – Schedule of Quantities and Prices
  - Appendix 2 – Preliminary Construction Schedule
  - Appendix 3 – Experience of Superintendent
  - Appendix 4 – Comparable Work Experience
  - Appendix 5 – Subcontractors
- Form of Agreement
  - Schedule 1 – Schedule of Contract Documents
  - Schedule 2 – Schedule of Contract Drawings
- Supplementary General Conditions (SGC)
- Supplementary Specifications (SS)
- Supplementary Detail Drawings

2. Documents that must be obtained by the Tenderer/Contractor:

- Master Municipal Construction Documents, Platinum Edition Volume II, 2009
  - Instructions to Tenderers Part II
  - General Conditions
  - Standard Specifications
  - Standard Detail Drawings
- All MMCD Platinum Supplemental Updates published prior to the issue date of the Invitation to Tender (document corrections prepared by MMCDA available at **http://www.mmcd.net**).

Owner: ***Regional District of Nanaimo***

Contract: ***Whiskey Creek Water Service Area – Production Well Site***

Reference No.: ***21-008***

The Owner invites tenders for: The supply, installation and start-up of a new production well and associated kiosk that will house a UV system, well controls and communications. Project includes process, HVAC and electrical at the production well site, including a new standby generator. Civil work will be required for pipe connections to the production well and site grading.

Contract Documents **may be viewed and obtained at:** Tender Documents, Tender Drawings and Reference Material for this project will be distributed electronically in digital format (PDF format) through the BC Bid tendering website at http://www.bcbid.gov.ba.ca/. For personal hard copies, it is the responsibility of the Contractor to download the PDF and print as needed. The tenderer is solely responsible for ensuring and addenda are downloaded, reviewed and included in their bid.

A mandatory pre-tender site meeting will be held: A mandatory pre-tender site meeting will be held at the time and place specified on the cover page.

Tenders are scheduled to close:

Tender Closing Time: 3 : 00 , 00 pm, local time

Tender Closing Date: March 4 , 20 21

Email: gstpierre@rdn.bc.ca

(EMAIL ADDRESS WHERE TENDERS MUST BE SUBMITTED)

NAME OF *OWNER'S* REPRESENTATIVE

Jill Hardy, P.Eng.

MPE Engineering Ltd.

403-219-6319 jhardy@mpe.ca

(PHONE) (EMAIL)

1.0 Introduction ..... IT - 1

2.0 Tender Documents ..... IT - 1

3.0 Submission of Tenders ..... IT - 2

4.0 Additional Instructions to Tenderers ..... IT - 3

THIS PAGE INTENTIONALLY LEFT BLANK

**(TO BE READ WITH "INSTRUCTIONS TO TENDERERS - PART II"
CONTAINED IN THE EDITION OF THE PUBLICATION
"MASTER MUNICIPAL CONSTRUCTION DOCUMENTS" SPECIFIED IN ARTICLE 2.2 BELOW)**

Owner: ***Regional District of Nanaimo***
(NAME OF OWNER)

Contract: ***Whiskey Creek Water Service Area – Production Well Site***
(TITLE OF CONTRACT)

Reference No.: ***21-008***
(OWNER'S CONTRACT REFERENCE NO.)

1.0 Introduction

1.1 These Instructions apply to and govern the preparation of tenders for this *Contract*. The *Contract* is generally for the following work:

The supply, installation and start-up of a new production well and associated kiosk that will house a UV system, well controls and communications. Project includes process, HVAC and electrical at the production well site, including a new standby generator. Civil work will be required for pipe connections to the production well and site grading.

1.2 Direct all inquiries regarding the *Contract*, to:

Jill Hardy, P.Eng.

Address: MPE Engineering Ltd.
Suite #320, 6715 – 8 Street NE
Calgary, AB
T2E 7H7

Phone: 403-219-6319

Email: jhardy@mpe.ca

2.0 Tender Documents

2.1 The tender documents which a tenderer should review to prepare a tender consist of all of the *Contract Documents* listed in Schedule 1 entitled "Schedule of Contract Documents". Schedule 1 is attached to the Agreement which is included as part of the tender package. The *Contract Documents* include the drawings listed in Schedule 2 to the Agreement, entitled "List of *Contract Drawings*".

2.2 A portion of the *Contract Documents* are included by reference. Copies of these documents have not been included with the tender package. These documents are the Instructions to Tenderers - Part II, General Conditions, Specifications and Standard Detail Drawings. They are those contained in the publication entitled "Master Municipal Construction Documents - General Conditions, Specifications and Standard Detail Drawings". Refer to Schedule 1 to the Agreement or, if not specified in Schedule 1, then the applicable edition shall be the most recent edition as of the date of the *Tender Closing Date.* All sections of this publication are by reference included in the *Contract Documents*.

2.3 Any additional information made available to tenderers prior to the *Tender Closing Time* by the *Owner* or representative of the *Owner,* such as geotechnical reports or as-built plans, which is not expressly included in Schedule 1 or Schedule 2 to the Agreement, is not included in the *Contract Documents*. Such additional information is made available only for the assistance of tenderers who must make their own judgment about its reliability, accuracy, completeness and relevance to the *Contract*, and neither the *Owner* nor any representative of the *Owner* gives any guarantee or representation that the additional information is reliable, accurate, complete or relevant.

3.0 Submission of Tenders

3.1 Tenders must be submitted via email, clearly marked in the subject line with the above *Contract* Title and Reference No., and must be received by the office of:

Gerald St.Pierre, P.Eng., PMP
Project Engineer, Water Services

At: gstpierre@rdn.bc.ca via email

on or before: 3:00:00 pm, local time
Thursday, March 4, 2021

3.2 The time as indicated by the declining time clock on the Owner's Email System shall be the official time for closing. Bids submitted after the Owner's Email System closing time will not be accepted.

3.3 Hard copy, oral, telephone or fax bids will not be accepted nor acknowledged.

3.4 Bidders **must** supply with their Tenders a **verifiable digital Bid Bond (e-bond) and a verifiable digital Consent of Surety** as defined by the Surety Association of Canada https://suretycanada.com/SAC/Surety-Bonds/E-Bonding.aspx. Scanned copies are not acceptable.

4.0 Additional Instructions to Tenderers

4.1 **The RDN (Owner) reserves the right to:**

a) reject any or all bids;

b) select a *Contractor* that will give the greatest value based on quality, experience, service, schedule, and price;

c) in its absolute discretion, reject a Tender, if the Bidder, or any officer or director of the Bidder is or has been engaged either directly or indirectly through another corporation in legal action against the RDN, its elected of appointed offices and employees in relation to:

   a. any other contract for works or services; or

   b. any matter arising from the RDN's exercise of its powers, duties, or functions under the Local

Government Act, Community Charter, or another enactment within five years of the date of this Tender call.

In determining whether to reject a Tender under this clause, the RDN will consider whether the litigation is likely to affect the Bidder's ability to work with the RDN, its consultants and representatives and whether the RDN's experience with the Bidder indicates that the RDN is likely to incur increased staff and legal costs in the administration of this Contract if it is awarded to the Bidder.

c. cancel this tender at any time up until award;

d) reject a bid from a tenderer who, based on an evaluation of the information provided by the *Contractor* in Appendix 3 and Appendix 4 of the Form of Tender, has not provided adequate experience details and references for the *Contractor* and/or the *Superintendent;*

e) reject any bid that is incomplete, unsigned, improperly signed, conditional, illegible, contains arithmetical errors, erasures or irregularities of any kind; and

f) change the scope of *Work* and retender the project.

4.2 Conflict of Interest

Prior to submitting a Tender, Bidders shall disclose any potential conflict of interest or existing business relationships they may have with the RDN, its elected or appointed officials or employees.

4.3 Award of Contract

The award of this contract is subject to the availability of sufficient funds to complete the work, and the approval of RDN Senior Management or the RDN Board of Directors.

4.4 Access and Laydown

The site has no specific access. It is the responsibility of the *Contractor* to determine appropriate site access and laydown where work is being done. Laydown of materials and equipment shall not cause an inconvenience to residents or impact the safe and reasonable movement or vehicles or pedestrians.

4.5 Construction Site Surface Features

The existence and location of all surface features which may be encountered during construction are not guaranteed to be shown on the *Drawings*. Notwithstanding any other provision of this *Contract*, the *Contractor* shall be solely responsible for confirming the existence, extent and location of surface features either shown on the *Drawings* or not, and the effect they may have on the *Work*. Surface features to be confirmed as part of the tender preparation shall include but not be limited to retaining walls, trees, shrubbery, ornamental features, signs, walkways, fences, irrigation and utility boxes, power poles and light standards. Unless specifically noted otherwise, no additional compensation will be made for protection, restoration or removal of surface features affected by the *Work*, or for the effect they may have upon the *Work* itself, unless otherwise noted in the *Contract Documents*.

4.6 Deadline for Questions

Questions and clarifications regarding the Tender should be submitted no later than three business days prior to the *Tender Closing Date* and *Tender Closing Time*.

4.7 Survey Layout and Digital Base Drawing

Survey layout for all Work shall be the *Contractor's* responsibility. The *Contract Administrator* will provide a digital base plan in AutoCAD format, including survey control points and bench marks. The *Contractor's* surveyor shall locate, confirm and protect control points and preserve permanent reference points during construction, including property pins and survey monuments. Refer to SS 01 56 10.

FOR USE WHEN UNIT PRICES FORM THE BASIS OF PAYMENT - TO BE USED ONLY WITH THE GENERAL CONDITIONS AND OTHER STANDARD DOCUMENTS OF THE UNIT PRICE MASTER MUNICIPAL CONSTRUCTION DOCUMENTS

Owner: ***Regional District of Nanaimo***
(NAME OF OWNER)

Contract: ***Whiskey Creek Water Service Area – Production Well Site***
(TITLE OF CONTRACT)

Reference No.: ***21-008***
(OWNER'S CONTRACT REFERENCE NO.)

To *Owner*:

WE, THE UNDERSIGNED:

1.1 have received and carefully reviewed all of the *Contract Documents*, including the Instructions to Tenderers, the specified edition of the "Master Municipal Construction Documents - General Conditions, Specifications and Standard Detail Drawings" and the following Addenda:

_____

_____

_____ ;
(ADDENDA, IF ANY)

1.2 have full knowledge of the *Place of the Work*, and the *Work* required; and

1.3 have complied with the Instructions to Tenderers; and

ACCORDINGLY WE HEREBY OFFER

2.1 to perform and complete all of the *Work* and to provide all the labour, equipment and material all as set out in the *Contract Documents*, in strict compliance with the *Contract Documents*; and

2.2 to achieve Substantial Performance of the Work on or before September 30, 2021; and
(WORK DURATION OR DATE)

2.3 to do the *Work* for the price, which is the sum of the products of the actual quantities incorporated into the *Work* and the appropriate unit prices set out in Appendix 1, the "*Schedule of Quantities and Prices*", plus any lump sums or specific prices and adjustment amounts as provided by the *Contract Documents*. For the purposes of tender comparison, our offer is to complete the *Work* for the "*Tender Price*" as set out on Appendix 1 of this Form of Tender. Our *Tender Price* is based on the estimated quantities listed in the *Schedule of Quantities and Prices*, and excludes *GST*.

WE CONFIRM: 3.1 that we understand and agree that the quantities as listed in the *Schedule of Quantities and Prices* are estimated, and that the actual quantities will vary.

WE CONFIRM: 4.1 that the following appendices are attached to and form a part of this tender:

4.1.1 the appendices as required by paragraph 5.3 of the Instructions to Tenderers – Part II; and

4.1.2 the *Bid Security* as required by paragraph 5.2 of the Instructions to Tenderers – Part II and in the Supplementary General Conditions.

WE AGREE: 5.1 that this tender will be irrevocable and open for acceptance by the *Owner* for a period of **90** calendar days from the day following the *Tender Closing Date and Time*, even if the tender of another tenderer is accepted by the *Owner*. If within this period the *Owner* delivers a written notice ("*Notice of Award*") by which the *Owner* accepts our tender we will:

5.1.1 within 15 *Days* of receipt of the written *Notice of Award* deliver to the *Owner*:

.1 a Performance Bond and a Labour and Material Payment Bond, each in the amount of 50% of the Contract Price, covering the performance of the Work including the Contractor's obligations during the Maintenance Period, issued by a surety licensed to carry on the business of suretyship in the province of British Columbia, and in a form acceptable to the Owner;

.2 a Baseline Construction Schedule, as provided by GC 4.6.1;

.3 a "clearance letter" indicating that the tenderer is in Worksafe BC compliance; and

.4 a copy of the insurance certificates as specified in GC 24 indicating that all such insurance coverage is in place and;

5.1.2 within 2 *Days* of receipt of written "*Notice to Proceed*", or such longer time as may be otherwise specified in the *Notice to Proceed*, commence the *Work*; and

5.1.3 sign the Contract Documents as required by GC 2.1.2.

WE AGREE:

6.1 that, if we receive written *Notice of Award* of this *Contract* and, contrary to paragraph 5 of this Form of Tender, we:

6.1.1 fail or refuse to deliver the documents as specified by paragraph 5.1.1 of this Form of Tender; or

6.1.2 fail or refuse to commence the *Work* as required by the *Notice to Proceed*,

then such failure or refusal will be deemed to be a refusal by us to enter into the *Contract* and the *Owner* may, on written notice to us, award the *Contract* to another party. We further agree that, as full compensation on account of damages suffered by the *Owner* because of such failure or refusal, the *Bid Security* shall be forfeited to the *Owner*, in an amount equal to the lesser of:

6.1.3 the face value of the *Bid Security*; and

6.1.4 the amount by which our *Tender Price* is less than the amount for which the *Owner* contracts with another party to perform the *Work*.

OUR ADDRESS IS AS FOLLOWS:

_____

_____

_____

Phone: _____

Fax: _____

Attention: _____

This Tender is executed this
_____ day of _____, 20 _____.

Contractor:

_____
(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

_____
(AUTHORIZED SIGNATORY)

_____
(AUTHORIZED SIGNATORY)

Appendix 1

See Paragraph 5.3.1 of the Instructions to Tenderers – Part II

(All Prices and Quotations should not include GST. GST should be shown separately)

Summary Sheet

Division 01:	General Requirements	$_____
Division 03:	Concrete	$_____
Division 13:	Special Construction	$_____
Division 23:	HVAC	$_____
Division 26:	Electrical	$_____
Division 32:	Roads and Site Improvements	$_____
Division 33:	Utilities	$_____
Division 35:	Mobilization and Demobilization	$_____
Division 40:	Process Integration	$_____
Division 46:	Water and Wastewater Equipment	$_____

Tender Price	$_____
GST @ 5%	$_____
Total Tender Price (Including GST)	$_____

Appendix 1

See Paragraph 5.3.1 of the Instructions to Tenderers – Part II

(All Prices and Quotations should not include GST. GST should be shown separately)

Section	Item #	Item Description	Unit	Qty.	Unit Price	Amount
Division 01 – General Requirements						
01 33 01	1.1	Project Record Documents	L.S.	1		
SS 01 56 01	1.2	Construction Survey Layout	L.S.	1		
					Subtotal Division 01 – General Requirements	
Division 03 – Concrete						
		Thrust Blocks to be included under Division 33 Items	Note			
SS 03 30 10	3.1	Cast-in-Place Concrete	L.S.	1		
					Subtotal Division 03 – Concrete	
Division 13 – Special Construction						
SS 13.0	13.1	Kiosk Structure	L.S.	1		
					Subtotal Division 13 – Special Construction	
Division 23 – HVAC						
SS 23	23.1	Kiosk HVAC	L.S.	1		
					Subtotal Division 23 – HVAC	
Division 26 – Electrical						
SS 26	26.1	Well and Kiosk Electrical	L.S.	1		
SS 26	26.2	Pump Station Electrical	L.S.	1		
SS 26	26.3	Generator Electrical	L.S.	1		
					Subtotal Division 26 – Electrical	
Division 31 – Earthworks						
		All Division 31 items required to complete the *Work* to be included under Division 03 and 33 items.	Note			
					Subtotal Division 31 – Earthworks	N/A
Division 32 – Roads and Site Improvements						
		Surface restoration to include all costs required to restore the surface to existing conditions or better.	Note			
	32.1	Well Site	L.S.	1		
					Subtotal Division 32 – Roads and Site Improvements	
Division 33 – Utilities						
33 11 01		**Waterworks**				
		Fittings, bends, reducers, tees. caps, couplers, adaptors, thrust blocks, crossing of water services, testing and commissioning including installation and removal of temporary test points are incidental to the watermain unit prices	Note			
	33.1	Connection to Water Well	L.S.	1		
	33.2	Connection to Temporary Transmission Main	L.S.	1		
	33.3	75mm HDPE DR 11 Watermain	M	25		
	33.4	75mm Gate Valve	Ea.	1		
SS 33 21 00	33.4	Submersible Turbine Pump	L.S.	1		
					Subtotal Division 33 – Utilities	

Appendix 1

See Paragraph 5.3.1 of the Instructions to Tenderers – Part II

(All Prices and Quotations should not include GST. GST should be shown separately)

Division 35 – Mobilization and Demobilization						
SS 35	35.1	Mobilization and Demobilization	L.S.	1		
					Subtotal Division 35 – Mobilization and Demobilization	
Division 40 – Process Integration						
SS 40	40.1	Well and Kiosk - Process	L.S.	1		
					Subtotal Division 40 – Process Integration	
Division 46 – Water and Wastewater Equipment						
SS 46	46.1	UV Disinfection System	L.S.	1		
					Subtotal Division 46 – Water and Wastewater Equipment	

Whiskey Creek Water Service Area – Production Well Site

(TITLE OF CONTRACT)

See paragraph 5.3.2 of the Instructions to Tenderers – Part II.

Indicate Schedule with bar chart with major item descriptions and time.

MILESTONE DATES:

Milestone 1: Substantial Performance September 30, 2021

Milestone 2: Total Performance October 31, 2021

ACTIVITY	CONSTRUCTION SCHEDULE																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Tenderer's Initials _____

Whiskey Creek Water Service Area – Production Well Site

(TITLE OF CONTRACT)

See paragraph 5.3.3 of the Instructions to Tenderers – Part II.

Name: _____

Experience:

Dates: _____

Project Name: _____

Responsibility: _____

_____

_____

_____

References: _____

_____

Dates: _____

Project Name: _____

Responsibility: _____

_____

_____

_____

References: _____

_____

Dates: _____

Project Name: _____

Responsibility: _____

_____

_____

_____

References: _____

_____

Dates: _____

Project Name: _____

Responsibility: _____

_____

_____

_____

References: _____

Tenderer's Initials _____

Whiskey Creek Water Service Area – Production Well Site

(TITLE OF CONTRACT)

See paragraph 5.3.4 of the Instructions to Tenderers – Part II.

PROJECT	OWNER / CONTACT NAME PHONE AND FAX	WORK DESCRIPTION	VALUE ($)
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		
	Owner / Contract _____ Phone ( ) _____ Fax ( ) _____		

Whiskey Creek Water Service Area – Production Well Site

(TITLE OF CONTRACT)

See paragraph 5.3.5 of the Instructions to Tenderers – Part II.

TENDER ITEM	TRADE	SUBCONTRACTOR NAME	PHONE NUMBER

Tenderer's Initials _____

BETWEEN *OWNER* AND *CONTRACTOR*

This agreement made in duplicate this

_____ day of _____, 20_____.

Contract: **Whiskey Creek Water Service Area – Production Well Site**
(TITLE OF CONTRACT)

Reference No.: **21-008**
(OWNER'S CONTRACT REFERENCE NO.)

BETWEEN:

The **Regional District of Nanaimo**
(NAME OF OWNER)

(the "*Owner*")

AND:

_____

_____

_____
(NAME AND OFFICE ADDRESS OF CONTRACTOR)

(the "*Contractor*")

The *Owner* and the *Contractor* agree as follows:

Article 1 The Work Start / Completion Dates

1.1 The *Contractor* will perform all *Work* and provide all labour, equipment and material and do all things strictly as required by the *Contract Documents*.

1.2 The *Contractor* will commence the *Work* in accordance with the *Notice to Proceed*. The *Contractor* will proceed with the *Work* diligently, will perform the *Work* generally in accordance with the construction schedules as required by the *Contract Documents* and will achieve *Substantial Performance* of the *Work* on or before the date indicated on the Form of Tender, subject to the provisions of the *Contract Documents* for adjustments to the *Contract Time*.

1.3 Time shall be of the essence of the *Contract.*

Article 2 Contract Documents

2.1 The "*Contract Documents*" consist of the documents listed or referred to in Schedule 1, entitled "Schedule of Contract Documents", which is attached and forms a part of this Agreement, and includes any and all additional and amending documents issued in accordance with the provisions of the *Contract Documents*. All of the *Contract Documents* shall constitute the entire *Contract* between the *Owner* and the *Contractor*.

2.2 The *Contract* supersedes all prior negotiations, representations or agreements, whether written or oral, and the *Contract* may be amended only in strict accordance with the provisions of the *Contract Documents.*

Article 3 Contract Price

3.1 The price for the *Work* ("*Contract Price*") shall be the sum in Canadian dollars of the following

3.1.1 the product of the actual quantities of the items of *Work* listed in the *Schedule of Quantities and Prices* which are incorporated into or made necessary by the *Work* and the unit prices listed in the *Schedule of Quantities and Prices*; plus

3.1.2 all lump sums, if any, as listed in the *Schedule of Quantities and Prices*, for items relating to or incorporated into the *Work*; plus

3.1.3 any adjustments, including any payments owing on account of *Changes* and agreed to *Extra Work*, approved in accordance with the provisions of the *Contract Documents.*

3.2 The *Contract Price* shall be the entire compensation owing to the *Contractor* for the *Work* and this compensation shall cover and include all profit and all costs of supervision, labour, material, equipment, overhead, financing, and all other costs and expenses whatsoever incurred in performing the *Work*.

Article 4 Payment

4.1 Subject to applicable legislation and the provisions of the *Contract Documents*, the *Owner* shall make payments to the *Contractor*.

4.2 If the *Owner* fails to make payments to the *Contractor* as they become due in accordance with the terms of the *Contract Documents* then interest calculated at 2% per annum over the prime commercial lending rate of the Royal Bank of Canada on such unpaid amounts shall also become due and payable until payment. Such interest shall be calculated and added to any unpaid amounts monthly.

Article 5 Rights and Remedies

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

5.2 Except as specifically set out in the *Contract Documents*, no action or failure to act by the *Owner*, *Contract Administrator* or *Contractor* shall constitute a waiver of any of the parties' rights or duties afforded under the *Contract*, nor shall any such action or failure to act constitute an approval of or acquiescence in any breach under the *Contract*.

Article 6 Notices

6.1 Communications among the *Owner*, the *Contract Administrator* and the *Contractor*, including all written notices required by the *Contract Documents*, may be delivered by hand, or by email, or by pre-paid registered mail to the addresses as set out below:

The *Owner*:

Regional District of Nanaimo
6300 Hammond Bay Road
Nanaimo, BC
V9T 6N2
Phone: 250-390-6751
Email: gstpierre@rdn.bc.ca
Attention: Gerald St. Pierre, P.Eng.

The *Contractor*:

_____

_____

_____

Email: _____

Attention: _____

The *Contract Administrator*:

MPE Engineering Ltd.
Suite #320, 6715 – 8Street NE
Calgary, AB
T2E 7H7
Phone: 403-219-6319
Email: jhardy@mpe.ca
Attention: Jill Hardy, P.Eng.

6.2 A communication or notice that is addressed as above shall be considered to have been received

6.2.1 immediately upon delivery, if delivered by hand; or

6.2.2 immediately upon transmission if sent by email; or

6.2.3 after 5 *Days* from date of posting if sent by registered mail.

6.3 The *Owner* or the *Contractor* may, at any time, change its address for notice by giving written notice to the other at the address then applicable. Similarly, if the *Contract Administrator* changes its address for notice then the *Owner* will give or cause to be given written notice to the *Contractor.*

Article 7 General

7.1 This *Contract* shall be construed according to the laws of British Columbia.

7.2 The *Contractor* shall not, without the express written consent of the *Owner*, assign this *Contract*, or any portion of this *Contract*.

7.3 The headings included in the *Contract Documents* are for convenience only and do not form part of this *Contract* and will not be used to interpret, define or limit the scope or intent of this *Contract* or any of the provisions of the *Contract Documents*.

7.4 A word in the *Contract Documents* in the singular includes the plural and, in each case, vice versa.

7.5 This agreement shall ensure to the benefit of and be binding upon the parties and their successors, executors, administrators and assigns.

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

Contractor:

(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

(AUTHORIZED SIGNATORY)

(AUTHORIZED SIGNATORY)

Owner:

Regional District of Nanaimo

(FULL LEGAL NAME OF CORPORATION, PARTNERSHIP OR INDIVIDUAL)

(AUTHORIZED SIGNATORY)

(AUTHORIZED SIGNATORY)

Schedule 1 Schedule of Contract Documents

The following is an exact and complete list of the *Contract Documents*, as referred to in Article 2.1 of the Agreement.

***NOTE*:** The documents noted with "*" are contained in the "Master Municipal Construction Documents - General Conditions, Specifications and Standard Detail Drawings", edition dated 2009. All sections of this publication are included in the *Contract Documents.*

8.1 Agreement, including all Schedules;

8.2 Supplementary General Conditions;

8.3 General Conditions*;

8.4 Supplementary Specifications;

8.5 Specifications*;

8.6 Supplementary Standard Detail Drawings;

8.7 Standard Detail Drawings*;

8.8 All MMCD Supplemental Updates published prior to the issue date of the Invitation to Tender (available at **http://www.mmcd.net/**);

8.9 Executed Form of Tender, including all Appendices;

8.10 *Contract Documents* listed in Schedule 2 to the Agreement – "List of *Contract Documents*";

8.11 Instructions To Tenderers - Part I;

8.12 Instructions to Tenderers - Part II*;

8.13 The following Addenda:

_____

_____

_____

_____

_____

_____

_____

_____

(ADDENDA, IF ANY)

Schedule 2 List of Contract Documents

TITLE	DRAWING NO.	DATE
Title Page		2021-01-22
List of Drawings	G00.1	2021-01-22
Well Site Plan	C13.1	2021-01-22
Well Kiosk Concrete Pad	S11.1	2021-01-22
Instrumentation Legend	P00.1	2021-01-22
Process & Instrumentation Diagram Well Site	P12.1	2021-01-22
Process & Instrumentation Diagram Well Site Auxiliaries	P12.2	2021-01-22
Process & Instrumentation Diagram Reservoir and Pump Station	P22.1	2021-01-22
Well Kiosk Layout	P13.1	2021-01-22
Well Kiosk Section	P13.2	2021-01-22
Well Details	P14.1	2021-01-22
Miscellaneous Details	P15.1	2021-01-22
Well Kiosk Mechanical Layout	M11.1	2021-01-22
Electrical Legend	E00.1	2021-01-22
Instrument Wiring Typicals	E00.2	2021-01-22
Well Site Plan	E11.1	2021-01-22
Well Kiosk Floor Plan	E11.2	2021-01-22
Well Kiosk Section	E11.3	2021-01-22
Well Kiosk Section	E11.4	2021-01-22
Underground Cable Details	E11.5	2021-01-22
Well Details	E11.6	2021-01-22
Wells Single Line Diagram	E12.1	2021-01-22
Wells Panel Schedule	E12.2	2021-01-22
Wells Typical VFD Motor Control	E12.3	2021-01-22
Wells Cable Schedule	E12.4	2021-01-22
Wells Control Architecture	E13.1	2021-01-22

Wells Control Panel Layout	E13.2	2021-01-22
Wells Control Panel Bill of Materials & Label Schedule	E13.3	2021-01-22
Wells Control Panel Terminal Strip Layout	E13.4	2021-01-22
Wells Control Panel Power Distribution	E13.5	2021-01-22
Wells Signal Wiring Diagram	E13.6	2021-01-22
Wells PLC Analog Input/Output Modules	E13.11	2021-01-22
Wells PLC Digital Input Modules 1 and 2	E13.12	2021-01-22
Wells PLC Digital Output Module 1	E13.13	2021-01-22
Reservoir and Pump Station Site Plan	E21.1	2021-01-22
Pump Station Equipment Layout	E21.2	2021-01-22
Pump Station Single Line Diagram	E22.1	2021-01-22
Pump Station Cable Schedule	E22.4	2021-01-22
Pump Station Control Architecture	E23.1	2021-01-22
Pump Station Control Panel Layout	E23.2	2021-01-22
Pump Station Control Panel Bill of Materials & Label Schedule	E23.3	2021-01-22
Pump Station Control Panel Terminal Strip Layout	E23.4	2021-01-22
Pump Station Control Panel Power Distribution	E23.5	2021-01-22
Pump Station PLC Analog Input Module 1	E23.11	2021-01-22
Pump Station PLC Digital Input Module 1	E23.13	2021-01-22

SUPPLEMENTARY GENERAL CONDITIONS

Supplementary Specification:	**Instructions to Tenderers – Part II**		
Affected Document(s):	Volume II	**Change Type:**	Replacement
Section:	5.0 Tender Requirements	**Reference**	5.2
Change Summary:	Replace Section 5.2		
Currently:	5.2 A tender must be accompanied by tender security ("Bid Security") in the form of: 5.2.1 a bid bond issued by a surety licensed to carry on the business of suretyship in British Columbia in a form reasonably satisfactory to the Owner; or 5.2.2 cash, bank draft or letter of credit in aa form acceptable to the Owner; In an amount equal to 10% of the Tender Price.		
Should be:	5.2 A tender must be accompanied by tender security ("Bid Security") in an amount not less than 10% of the bid price. 5.2.1 Submit bid security with the Bid Form. Bids not accompanied by bid security will be rejected. 5.2.2 The Bid Bond must be a verifiable digital e-bond and a verifiable Consent of Surety to be legal per the Surety Association of Canada. Scanned copies are not acceptable. 5.2.3 Bid bonds shall be in accordance with the Canadian Construction Documents Committee (CCDC) Standard Form of Bid Bond, CCDC Document No. 220. 5.2.4 Bid bonds shall be issued by a duly incorporated surety company authorized to transact business of suretyship in the Province of British Columbia. 5.2.5. Bid bonds shall be properly executed by both the Bidder and the Surety. 5.2.6. If a Bidder whose bid is accepted by the Owner in writing, without qualification, and within the acceptance period specified in the Bid Documents, refuses or fails within 21 days after the date of issuance of the written acceptance of the bid: .1 To sign a formal Agreement with the owner for the performance of the Work, and .2 To provide contract performance security, or security for payment of claims, or both, if and as required by the Bid Document, The Bidder shall be liable to the Owner for the difference between the amount of its bid and the greater amount for which a contract for the Work is entered into with some other Bidder, up to the maximum amount of the bid security provided.		

Supplementary Specification:	**Instructions to Tenderers – Part II**		
Affected Document(s):	Volume II	**Change Type:**	Replacement/Addition
Section:	12.0 Amendment of Tenders	**Reference**	12.1

Change Summary:	Replace Section 12.1, Add 12.6 & 12.7
Currently:	**12.1** A tenderer may amend or revoke a tender by giving written notice, delivered by hand, mail or fax, to the office referred to in paragraph 3.1 of the Instruction to Tenderers – Part 1 at any time up until the Tender Closing Date and Time. An amendment or revocation that is received after the Tender Closing Date and Time shall not be considered and shall not affect a tender as submitted.
Should be:	**12.1** A tenderer may amend or revoke a tender by giving written notice, delivered by email, to the office referred to in paragraph 3.1 of the Instruction to Tenderers – Part 1 at any time up until the Tender Closing Date and Time. An amendment or revocation that is received after the Tender Closing Date and Time shall not be considered and shall not affect a tender as submitted. **12.6** Failure of a bid modification to arrive before the closing time, accurately or completely for any reason will render this tender amendment null and void. Failure of an emailed bid modification to arrive at the email system at the email address listed herein will render it null and void. **12.7** The Owner will assume no responsibility or liability for the content of amendments, or for amendments that are, for any reason delayed, illegible, unclear as to intent, ambiguous, contrary to these instructions, or otherwise improperly received.

Supplementary Specification:	**GC 1.67S – Substantial Performance**		
Affected Document(s):	Volume II	**Change Type:**	Replacement
Section:	General Conditions	**Reference**	GC 1.0 Definitions
Change Summary:	Replace Substantial Performance Definition with a New Definition		
Currently:	**1.67 "Substantial Performance"** means the stage of completion when: All *Work*, as certified by the *Contract Administrator*, is capable of completion or correction at a cost of not more than: (1) 3% of the first $500,000 of the *Contract Price*; (2) 2% of the next $500,000 of the *Contract Price*; and (3) 1% of the balance of the *Contract Price*: and the *Work*, or a substantial part of it, is ready for use or is being used for the purpose intended.		
Should be:	**1.67S "Substantial Performance"** means the stage of completion when: .1 All *Work*, as certified by the *Contract Administrator*, is capable of completion or correction at a cost of not more than: (1) 3% of the first $500,000 of the Contract Price; (2) 2% of the next $500,000 of the Contract Price; and (3) 1% of the balance of the Contract Price; and		

	.2 The *Work*, or a substantial part of it, is ready for use or is being used for the purpose intended; and .3 Digital as-built survey information, hardcopy redline markups, measurements, test results, video, manuals and other information specified and required from the contractor has been submitted to the *Contract Administrator*.

Supplementary Specification:	**GC 4.3.7S – Pre-Works Site Inspection**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	General Conditions	**Reference**	GC 4.3 Protection of Work, Property and the Public
Change Summary:	Addition of the requirement for a Pre-Works Site Inspection		
Currently:	Not Applicable		
Should be:	GC 4.3.7S Prior to mobilization and commencement of any construction the *Contractor* shall: 1. Undertake a photographic/video record inspection of the project site with specific emphasis on the condition of the roads, adjacent properties and infrastructure. Undertake the photographic/video record inspection with the *Site Inspector* present. 2. Provide a complete copy of the photographic/video record to the *Contract Administrator* after the inspection, which shall become the record of the condition of the project prior to construction.		

Supplementary Specification:	**GC 4.12.11S – Contractor Quality Control**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	General Conditions	**Reference**	GC 4.12 Tests and Inspections
Change Summary:	Add in testing and inspection requirements for *Quality Control* by the *Contractor*		
Currently:	Not Applicable		
Should be:	GC 4.12.11S The *Contractor* shall provide testing and inspections as part of *Quality Control* to meet the greater of the bylaw requirements where the *Work* is undertaken or the *Contract Documents* in terms of type of test frequency and number of tests required. Testing shall be undertaken by an accredited materials testing company customarily undertaking such work. Testing shall be overseen by a Professional Engineer registered to practice in the province of British Columbia.		

Supplementary Specification:	**GC 18.6.3S Letter of Credit**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	General Conditions	**Reference**	GC 18.6 Substantial Performance
Change Summary:	Add in requirement for letter of credit for maintenance period.		
Currently:	Not Applicable		
Should be:	GC 18.6.3S An irrevocable letter of Credit issued to the Regional District of Nanaimo for $20,000.00, in a form acceptable to the Owner, to be held by the Regional District of Nanaimo for the full duration of the Maintenance Period. This Letter of Credit will be held in addition to the Performance Bond and the Labour and Material Payment Bond described under the Form of Tender Section 5.1.1. The purpose of this Letter of Credit is to provide an additional guarantee for the Contractor's performance, and to provide a fund that can be drawn upon by the Owner, if the contractor fails to rectify deficiencies in the Work in a timely manner. More specifically, the Letter of Credit is intended to ensure that any issues related to trouble shooting and commissioning the Works are addressed in a timely manner by the Contractor during the Maintenance Period		

Supplementary Specification:	**GC 24.1.7S – Additional Named Insureds**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	General Conditions	**Reference**	GC 24.1 Required Insurance
Change Summary:	Add additional named insureds		
Currently:	Not Applicable		
Should be:	GC 24.1.7S The *Contractor* shall list the Regional District of Nanaimo and MPE Engineering Ltd. as additional name insureds.		

Supplementary Specification:	**GC 27.0S – COVID-19 Pandemic Response and Mitigation**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	General Conditions	**Reference**	General Conditions
Change Summary:	Add additional information on COVID-19 response and mitigation		
Currently:	Not Applicable		

Should be:	**GC 27.0 COVID -19 Pandemic Response and Mitigation** 27.1 The Contractor and the Owner acknowledge the presence of the COVID-19 virus in Canada and other jurisdictions forming part of the supply chain for materials and labour required for the Project (the "COVID-19 Pandemic"). 27.2 Known Impacts – The consequences and impacts of the COVID-19 Pandemic existing as of the date of this Contract include, without restriction: 27.2.1 Orders, directives and recommendations of any government authority issued up to and including the date of this Contract, and respecting public health or other requirements related to response to and prevention of infection by the COVID-19 virus; 27.2.2 impacts to availability of labour or materials required in order to carry out the Work, arising from the COVID-19 Pandemic; 27.2.3 the impacts of the Province of British Columbia withdrawing or deferring the advancement of any or all portions of their committed funding to the Project; 27.2.4 the impacts of self-isolation/quarantine or regulated quarantine as ordered by the Province of British Columbia; (the "**Known Impacts**"), and are known to the Contractor and to the Owner, and have been accounted for by the Contractor within the construction schedule, as well as the Contract Price. 27.3 Notwithstanding anything contained within the Contract, the Contractor and the Owner covenant and agree as follows:

27.3.1 no extension of the Contract Time or schedule shall be made and no adjustment to the Contract Price shall be made due to any Known Impacts.

27.3.2 for greater clarity and without limiting the generality of clause 27.3.1,

27.3.2.1 the Contractor shall not be entitled to any reimbursement of any costs and expenses incurred by the Contractor necessitated by a suspension or delay under clause 12 where the suspension is due to any Known Impacts;

27.3.2.2 notwithstanding anything contained within clause 13.0, a suspension of the Work because of any Known Impacts whether ordered by the Owner or the Owner's Representative or not, shall not be deemed to be a suspension of the Work within the meaning of clause 13.0;

27.3.2.3 notwithstanding anything contained within clause 13.0, no extension of the Contract Time shall be made and no adjustment in the Contract Price shall be made for any delay caused by a compliance with any order, directive or recommendation of any government authority related to the COVID-19 Pandemic, and/or caused by any other Known Impacts, whether ordered by the Owner or the Owner's Representative or not;

27.3.2.4 notwithstanding anything contained within clause 13.0, no extension of Contract Time shall be made and no adjustment in the Contract Price shall be made for any delay Claim that is based on the concept of the cumulative impact of any Known Impacts;

27.3.2.5 no extension of the Contract Time shall be made and no adjustment to the Contract Price shall be made due to any requirement that an employee of the Contractor or any Subcontractor self-isolate or quarantine as a result of a diagnosis or potential diagnosis as being COVID-19 positive;

27.4 Any Claims for adjustment in the Contract Price arising from or related to the COVID-19 Pandemic shall be net of any and all compensation schemes, support programs or other financial aids made available to the Contractor by any government authority.

SUPPLEMENTARY SPECIFICATIONS

Supplementary Specification:	**01 33 01 Project Record Documents** **1.7.5S – Digital Record Survey**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	01 33 01	**Reference**	1.7 Recording Actual Site Conditions
Change Summary:	Add in requirement for digital record survey		
Currently:	Not Applicable		
Should be:	1.7.5S .1 In addition to the items in 1.7.2 being provided as hardcopy redline markups, a complete record survey of infrastructure existing and ultimately installed shall be maintained by the *Contractor* and submitted to the *Contract Administrator* no later than *Substantial Performance*. .2 The submission to the *Contract Administrator* shall be in a digital format readily transferable into AutoCAD, and as accepted by the *Contract Administrator*. a. As part of the record survey the *Contractor* shall provide all buried changes or improvements including invert elevations, locations of all structures, pipes, rock horizons found/blasted, fittings, appurtenances, mitres, manholes, service connections, valves and tie-ins. b. As part of the record survey the *Contractor* shall pick up all existing infrastructure as found during excavation. c. As part of the record survey the *Contractor* shall provide all surface changes or improvements including landscaping, road changes or improvements, driveway changes or improvements, utility changes or improvements, relocated or new signage, relocated or new fencing, road markings and all other relocated or new traffic safety devices		

Supplementary Specification:	**01 33 01 Project Record Documents** **1.9S - Control & Quantity Measurements**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	01 33 01	**Reference**	1.0 General
Change Summary:	Add in requirement for quantity measurement		
Currently:	Not Applicable		
Should be:	1.9S .1 Digital survey control and digital construction details for layout will be provided by the *Contract Administrator* to the *Contractor*. .2 The *Contractor* shall provide digital quantity surveys/measurements for all phases of construction to provide volumes, areas and lengths for all payment items.		

	a. The *Contractor* shall allow the *Contract Administrator* to review all onsite quantity surveys undertaken during the course of construction. b. The *Contractor* shall provide the *Contract Administrator* all survey information in a logical format as gathered by the *Contractor* and as acceptable to the *Contract Administrator* in order to verify quantities and to aid in completion of *Payments Certificates*.

Supplementary Specification:	**01 33 01 Project Record Documents** **1.10S - Tests and Inspections Quality Control By Contractor**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	01 33 01	**Reference**	1.0 General
Change Summary:	Add in testing and inspecting requirements for Quality Control (QC) by the *Contractor*		
Currently:	Not Applicable		
Should be:	**1.10S** 1. All testing and inspections as part of Quality Control (QC) by the *Contractor* shall meet the bylaw requirements of the Owner or Regulatory Agency where the Works are undertaken in terms of type of test, frequency and number of tests required. 2. Testing shall be undertaken by an accredited materials testing company customarily undertaking such work. Testing will be overseen by a Professional Engineer registered to practice in the province of British Columbia. 3. For placement of gravels the *Contractor* shall provide: 1. Prior to delivery of gravels to the Work Place the *Contractor* shall select a pit/gravel source and provide the *Contract Administrator* a current copy of the sieve results detailing pit name/location/ownership and materials selected for use under the Contract 2. Ongoing sieve analysis of materials as delivered to the work site at a frequency meeting the Owners or Regulatory Agency's minimum requirements. 3. Compaction testing at the work site (testing of each lift and at a frequency meeting the Owners or Regulatory Agency's minimum requirements. 4. If the Owner or Regulatory Agency does not specifically detail tests, frequency and number, then the following as minimum shall apply: **For subgrade construction:** • Moisture - density relationship (Standard Proctor) - ASTM D1557; - one test for each soil type incorporated into the subgrade. • Moisture and density tests • Trench backfill - one test per lift per 50 linear metres of trench and one test per lift around manholes, valves, catch basins, etc. • Subgrade construction and preparation - three tests per 150 linear metres of road per lift, to include dry density and moisture content. • Geogrid reinforced fills – one test per 30 square meters of fill per lift, with a minimum of 1 test per lift, to include dry density and moisture content.		

	For subbase and base course construction: (including subgrade enhancement using subbase material) • Gradation analysis - one test per 500 m3 or 1100 tonnes of material delivered to the site. • Moisture - density relationship (Standard Proctor) - ASTM D1557; - one test per class of material for each 5000 m3, or 11000 tonnes delivered to site. • Compaction testing - three tests per 150 linear metres of road per lift, to include dry density and moisture content. 5. All test results shall be submitted to the *Contract Administrator* within 24 hours of receipt by the *Contractor*. 6. The Owner, for the Owners sole benefit, may undertake random Quality Assurance (QA) testing to ensure the *Contractor's* compliance with the Contract Specifications.

Supplementary Specification:	**SS 01 56 01 Construction Survey Layout**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 01 General Requirements	**Reference**	SS 01 56 01 Construction Survey Layout
Change Summary:	Add in SS 01 56 01 Construction Survey Layout (See attached) for survey layout by *Contractor*		

Supplementary Specification:	**01 57 01 Environmental Protection** **1.2.5S – Erosion and Sedimentation Control Plan**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 01 General Requirements	**Reference**	01 57 01 Temporary Erosion and Sediment Controls
Change Summary:	Requirement for an Erosion and Sedimentation Control Plan to be submitted.		
Currently:	Not Applicable		
Should be:	**1.2.5S** The *Contractor* shall provide a written Erosion and Sedimentation Control Plan to the *Owner* and *Contract Administrator* for review and comment a minimum of 7 days prior to commencing the field work. The plan should detail, materials, placement locations, maintenance and schedule specific to the project area for the implementation of Erosion and Sedimentation Control.		

Supplementary Specification:	**3.0S Concrete**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 03	**Reference**	SS 03 30 10
Change Summary:	Add Division 03 describing Cast-in-Place Concrete payment. Add in the following section: • SS 03 30 10 Cast-in-Place Concrete (see attached)		
Currently:	Not Applicable		
Should be:	3.1 Payment for cast in place concrete includes but is not limited to all labour, material and equipment to supply and install cast-in-place concrete structural slab, poly, steel reinforcing, forming, curing, placing and finishing, epoxy painting, insulation, void form, heating and hoarding if required, and all other related work for which payment is not included elsewhere.		

Supplementary Specification:	**13S Special Construction**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 13	**Reference**	
Change Summary:	Add Division 13 describing Kiosk Structure payment. Add in the following section: • SS 13 34 23 Fabricated Structures (see attached)		
Currently:	Not Applicable		
Should be:	13.1 Payment for the Kiosk Structure shall include provision of all equipment, materials and labour required for the supply and installation of the work shown on the Contract Drawings and in the Specifications. Includes all interior and exterior components, insulation, vapour barrier, walls, doors, hardware, ceiling, roof, paint, accessories, trim, finishes, vent, louvre and exhaust openings, anchoring to concrete pad, all work required by and recommended by the supplier for proper installation, and all related work for which payment is not included elsewhere.		

Supplementary Specification:	**23S HVAC**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 23	**Reference**	
Change Summary:	Add Division 23 describing Kiosk HVAC payment. Add in the following sections (see attached): • SS 23 81 20 • SS 23 82 05		
Currently:	Not Applicable		
Should be:	23.1 Payment for Kiosk HVAC work shall include provision of all equipment, materials and labour required for the supply and installation of the work shown on the Contract Drawings and in the Specifications. Includes waste disposal at approved facility, commissioning and testing by the supplier, all work required by and recommended by the supplier for proper installation. and all related work for which payment is not included elsewhere.		

Supplementary Specification:	**26S Electrical**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 26	**Reference**	
Change Summary:	Add Division 23 describing Electrical payment for the Well, Kiosk, Pump Station and Generator. Add in the following sections (see attached): • SS 26 05 00 Basic Electrical Requirements • SS 26 05 19 Wire and Cable • SS 26 05 26 Grounding • SS 26 05 33.13 Conduit • SS 26 05 33.16 Boxes and Fittings • SS 26 05 36 Cabletray Raceway Wireways • SS 26 05 53 Electrical Identification • SS 26 08 00 Electrical Starting and Testing • SS 26 22 00 Transformers • SS 26 27 16 Cabinets and Enclosures • SS 26 27 26 Wiring Devices • SS 26 29 23 Variable Frequency Drives • SS 26 32 13.0 Engine Generators Basic • SS 26 32 13.1 Generators • SS 26 32 13.2 Engine • SS 26 32 13.3 Cooling Equipment • SS 26 32 13.4 Exhaust Equipment • SS 26 32 13.5 Starting System • SS 26 32 13.6 Alarms and instrumentation		

Currently:	Not Applicable
Should be:	**26.1 & 26.2 Electrical Well, Kiosk and Pump Station** Payment for electrical work shall include provision of all equipment, materials and labour required for the supply and installation of the work shown on the Contract Drawings and in the Specifications. Includes removal and salvage of all existing equipment as required by the Owner, waste disposal at approved facility, excavation, site restoration, commissioning and testing by the supplier, all work required by and recommended by the supplier for proper installation, and all related work for which payment is not included elsewhere. **26.3 Generator** Payment for the supply and installation of the Generator includes but is not limited to all labour, materials and equipment to install the generator and associated equipment as shown on the Contract Drawings and in the Specifications. Includes commissioning and testing by the supplier, all work required by and recommended by the supplier for proper installation, and all related work for which payment is not included elsewhere.

Supplementary Specification:	**31 05 17 - 2.13S – Aggregates and Granular Material For This Project**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	31 05 17	**Reference**	2.0 Products
Change Summary:	Define acceptable granular material for this project		
Currently:	Not Applicable		
Should be:	2.13S .1 Aggregates and granular materials for this project shall be: a. Pipe Bedding: i. As per 2.7- Granular Pipe Bedding and Surround Material Type 1. b. Trench Fill and Subgrade Fill: i. As per 2.2 Native Material or, ii. as per 2.3 Pit Run Gravel 200 mm dia. minus, or iii. as per 2.3 Pit Run Gravel 100 mm dia. minus. c. Road and Structure Sub-Base: i. Subbase material in all BC Ministry of Transportation and Infrastructure public road rights of way must meet or exceed specified requirements for Select Granular Sub Base aggregates set out in Section 202.02 (Table 202-C) of the MC MoTI 2009 Standard Specifications for Highway Construction. Granular subbase material shall be SGSB and compacted to 100% SPMDD. d. Road and Structure Base:		

	i. Road base material in all BC Ministry of Transportation and Infrastructure public road rights of way must meet or exceed specified requirements for Base aggregates set out in Section 202.02 (Table 202-C) of the MC MoTI 2009 Standard Specifications for Highway Construction. Road base material shall be crushed base course and consist of 25mm minus WGB (or IGB) crushed aggregate. Granular base material is to be to compacted to 100% SPMDD. e. Drain Rock: i. As per 2.6 Drain Rock- 25 mm .2 The project does not allow for reuse of crushed asphalt.

Supplementary Specification:	**31 23 01 Excavating, Trenching and Backfilling** **1.0.2S – Minimum Cover Over Pipes**		
Affected Document(s):	Volume II	**Change Type:**	Change
Section:	31 23 01	**Reference**	1.0 General
Change Summary:	Define minimum cover over pipes		
Currently:	Various locations		
Should be:	1.0.2S – Minimum Cover Over Pipes: In all cases the minimum cover over all pipes shall be: .1 Watermains - Minimum Cover 1.20 m.		

Supplementary Specification:	**31 24 13 Roadway Excavation, Embankment and Compaction** **3.5.2S**		
Affected Document(s):	Volume II	**Change Type:**	Replacement
Section:	31 24 13	**Reference**	3.5 Compaction
Change Summary:	Define compaction requirements		
Currently:	3.5.2 Compact to density of not less than 95% Modified Proctor Density.		
Should be:	3.5.2S Compact to density of not less than 98% Standard Proctor Density.		

Supplementary Specification:	**33 11 01 Waterworks** **1.7.4S Scheduling of Work**		
Affected Document(s):	Volume II	**Change Type:**	Replacement
Section:	33 11 01	**Reference**	1.7 Scheduling of Work
Change Summary:	Replace 1.7.4		
Currently:	1.7.4 Do not interrupt water service for more than 3 h and confine this period between 09:00 and 16:00 h unless otherwise authorized.		
Should be:	1.7.4S Do not interrupt water service for more than 8 hours and confine this period between 08:00 and 17:00 h unless otherwise authorized.		

Supplementary Specification:	**33 11 01 Waterworks** **1.8 Measurement and Payment**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	33 11 01 Waterworks	**Reference**	1.8 Measurement and Payment
Change Summary:	Addition of payment items		
Currently:	Not Applicable		
Should be:	1.8.14S Fittings, bends, reducers, caps, couplers, adaptors, thrust blocks, and testing and commissioning including installation and removal of temporary test points are incidental to watermain unit prices. 1.8.15S Payment for Connection to Water Well shall be made at the unit rate bid price in the Schedule of Quantities and Prices. The unit price bid shall be full compensation for all equipment, labour and materials to expose the existing water well at the tie-in location and for the supply and installation of the work shown on the Contract Drawings and in the Specifications. Includes excavation, pitless adapter, fittings, couplers, pressure testing and disinfection, surface seal, well encasement, wellhead assembly, site restoration, removal and salvage of all existing piping, casing, equipment and fittings as necessary, all work required by and recommended by the supplier for proper installation; and all related work for which payment is not included elsewhere. 1.8.16S Payment for Submersible Turbine Pump shall be made at the unit rate bid price in the Schedule of Quantities and Prices. The unit price bid shall be full compensation for all equipment, labour and materials for the supply and installation of a submersible turbine pump as shown on the Contract drawings and in the Specifications. Includes valves, field devices, all related piping and fittings, couplers, pressure testing and disinfection, commissioning and testing by the supplier, site restoration, removal and		

	salvage of all existing piping, equipment and fittings as necessary, and all work required by and recommended by the supplier for proper installation; and all related work for which payment is not included elsewhere.

Supplementary Specification:	**33 11 01 Waterworks** **3.19.2S Testing Procedure**		
Affected Document(s):	Volume II	**Change Type:**	Replacement
Section:	33 11 01 Waterworks	**Reference**	3.19.2 Testing Procedure
Change Summary:	Add in pressure test requirements for HDPE pipe. Change the portion of the paragraph 3.19.2 as indicated below. The remainder of the paragraph remains unchanged.		
Currently:	Submit pipeline to a test of 1.5 x working pressure applied at highest elevation in each section, with a minimum of 1380 kPa applied at lowest point of test section.		
Should be:	Submit pipeline to a test of the greater of 1.5 x working pressure applied at the highest elevation in each section, or the pressure rating of each pipe type applied to the lowest elevation in each section.		

Supplementary Specification:	**33 11 01 Waterworks** **3.19.7S Testing Procedure**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	33 11 01 Waterworks	**Reference**	3.19 Testing Procedure
Change Summary:	Clarify pressure test requirements for HDPE pipe.		
Currently:	Not Applicable		
Should be:	3.19.7S Perform pressure and leakage testing of High Density Polyethylene (HDPE) piping to ASTM F 2164.		

Supplementary Specification:	**33 11 01 Waterworks** **3.21.10S Disinfection and Flushing Procedures**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	33 11 01 Waterworks	**Reference**	3.21. Disinfection and Flushing Procedures
Change Summary:	Add requirements for bacteriological testing		
Currently:	Not Applicable		

Should be:	3.21.10S The *Contractor* shall be responsible for collecting two consecutive sets of samples taken at least 16 hours apart for testing of bacteriological quality in accordance with AWWA C651. Sets of samples shall be collected from every 370m of new water main, plus one set from each end of the line. The *Contractor* shall submit the results of the bacteriological quality tests to the *Contract Administrator*. The *Contractor* shall provide a written procedure to the *Owner* and *Contract Administrator* for review and comment a minimum of 7 days prior to commencing the testing work.

Supplementary Specification:	**35S Mobilization and Demobilization**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 35	**Reference**	
Change Summary:	Add Division 35 describing mobilization and demobilization payment		
Currently:	Not Applicable		
Should be:	35.1 Payment for mobilization and demobilization includes costs for preparatory work and operations including those necessary for the movement of material, labour and equipment to and from the *Place of the Work*. This item includes all other work or costs incurred prior to the beginning of the Work and following completion of the *Work* on various items on the project and all related work for which payment is not included elsewhere. Payment for Mobilization and Demobilization will be as follows: 1. When 5% of the original contract amount is earned, 25% of the lump sum bid for “Mobilization and Demobilization” will be paid. 2. When 10% of the original contract amount is earned, 50% of the lump sum bid for “Mobilization and Demobilization” will be paid. 3. When 25% of the original contract amount is earned, 60% of the lump sum bid for “Mobilization and Demobilization” will be paid. 4. When 50% of the original contract amount is earned, 70% of the lump sum bid for “Mobilization and Demobilization” will be paid. 5. Upon *Total Completion* of all work on the Project, 100% of the lump sum bid for “Mobilization and Demobilization” will be paid. The total payments for this item shall not exceed the original amount bid for this item regardless of the fact that the *Contractor* may have for any reason shut down the *Work* on the project or moved equipment away from the project and then back again. The final payment amount will not factor into the calculation for determination of *Substantial Performance*.		

Supplementary Specification:	**40S Process Integration**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 40	**Reference**	
Change Summary:	Add Division 40 describing process payment. Add in the following sections (attached): • SS 40 00 00 Mechanical General Requirements • SS 40 05 07 Hangers and Supports • SS 40 05 40 Detailed Piping Specifications • SS 40 05 90 Valves • SS 40 80 01 Disinfection, Hydrostatic and Pressure Testing • SS 40 90 00 Instrumentation and Control for Process Systems • SS 40 91 00 Process Measurement Devices • SS 40 95 00 Process Control Hardware • SS 40 95 13 Instrument Control Panel • SS 40 95 73 Instrument Wiring		
Currently:	Not Applicable		
Should be:	40.1 Payment for process work shall include provision of all equipment, materials and labour required for the supply and installation of the work shown on the Contract Drawings and in the Specifications. Includes excavation, waste excavation, valves, field devices, all related process piping and fittings, couplers, pressure testing and disinfection, commissioning and testing by the supplier, site restoration, removal and salvage of all existing process piping, equipment and fittings as necessary all work required by and recommended by the supplier for proper installation; and all related work for which payment is not included elsewhere.		

Supplementary Specification:	**46S Water and Wastewater Equipment**		
Affected Document(s):	Volume II	**Change Type:**	Addition
Section:	Division 46	**Reference**	
Change Summary:	Add Division 46 describing UV Disinfection system payment. Add in the following section and addition of payment items: • SS 46 66 13 UV Disinfection System (attached)		
Currently:	Not Applicable		
Should be:	46.1 Payment for UV Disinfection System shall include provision of all equipment, materials and labour required for the supply and installation of the work shown on the Contract Drawings and in the Specifications. Includes excavation, waste excavation, valves, field devices, all related process piping and fittings, couplers, pressure testing and disinfection, commissioning and testing by the supplier, site restoration, removal and salvage of all existing process piping, equipment and		

	fittings as necessary all work required by and recommended by the supplier for proper installation; and all related work for which payment is not included elsewhere.

1. GENERAL

1.1 SURVEY REFERENCE POINTS

.1 Primary horizontal and vertical survey reference points have been established by the Owner as specified in the Contract Documents. The Owner is responsible for the accuracy of the primary survey reference points.

.2 Locate, confirm, and protect primary reference points prior to starting *Work* on the *Site*. Preserve permanent reference points during construction.

.3 Make no changes to or relocations of the primary survey reference points without prior written authorization of the Owner.

.4 Report to the Owner when a reference point is lost or damaged, or requires relocation because of the Work.

.5 Replace damaged reference points in accordance with the original survey control.

1.2 CONTRACTOR SURVEY WORK

.1 Employ qualified construction surveyors to perform survey work.

.2 Record survey data in accordance with standard survey methods in a form acceptable to the Owner.

.3 Establish secondary survey reference points required for laying out and staking the Work and for checking tolerances. Be solely responsible for the accuracy of the secondary survey reference points and the layout, staking, and checking of the Work.

.4 Establish lines, grades, and elevations, and locate and lay out the Work.

.5 Provide final grade staking of each line, grade or elevation required for the Owner's checking of the work and for measurement for payment purposes for checking by the Owner. Maintain final grade stakes in place until the Owner has authorized their removal.

.6 Provide such assistance as may be required by the Owner for carrying out surveys in Article 1.4.

.7 Establish and maintain survey reference points in all work areas, including elevations and locations relative to established stationing and offset systems or otherwise required by the Owner. Provide reference points within 50 m horizontal distance and 2 m vertical distance of all locations where testing, observations of conditions, or other similar activities are undertaken by the Owner, such that the Owner can establish the location and elevations at those locations.

.8 Carry out topographic surveys for the purpose of measuring the *Work* for payment. Provide electronic survey data files in a form acceptable to the *Owner* for verification.

1.3 GLOBAL POSITIONING SYSTEMS (GPS)

.1 If GPS controlled excavation and trimming equipment is utilized in conjunction with GPS final grade checking, the Owner may waive the requirement for final grade stakes if the accuracy and consistency of the final grade check can be demonstrated.

.2 If the final grade stake requirement is waived, provide a surface grade sheet in electronic and hard copy of the electronic survey data in a format acceptable to the Owner.

.3 The surface grade sheet to include the following minimum information:

.1 Station.

.2 Offset left or right of the centerline.

.3 Design elevation at the grade line break point.

.4 Actual elevation at the grade line break point.

.5 Deviation of the actual elevation from the design elevation.

.6 Indication if deviation is within specified tolerances.

1.4 OWNER'S SURVEY REQUIREMENTS

.1 The *Owner* may carry out surveys, as the *Owner* deems necessary, to check the accuracy of the *Contractor's* layout and stakes.

.2 The *Owner* may carry out surveys for the purpose of confirming Contractor's measurement for payment.

1.5 SUBMITTALS

.1 Provide the following submittals.

.2 The name and address of the *Contractor's* surveyor to the *Owner* prior to commencing the *Work* at the *Site*.

.3 When requested, submit a copy of reduced notes for surveys or portions of surveys to the Owner.

.4 A certificate signed by the *Contractor's* surveyor confirming that the lines, grades, elevations, and dimensions of the completed Work are in conformance or not in conformance with the *Contract Documents*. Provide details of all non-conformances.

.5 Electronic survey data files in a format acceptable to the *Owner*.

1.6 ELECTRONIC DESIGN DATA

.1 Electronic design data is available from the Owner's Representative upon request. This information is intended as an aid for construction layout. The Owner's Representative does not guarantee its accuracy. Any discrepancies between the electronic design data and the drawings must be brought to the attention of the Owner's Representative immediately. Information provided on the drawings will take precedence over electronic design data.

1.7 MEASUREMENT AND PAYMENT

.1 The lump sum bid price for Construction Survey Layout shall be full compensation for supervision, labour, materials and equipment necessary to stake out the location of the watermain bends, fittings, appurtenances, complete all necessary topographic suveys for quantity confirmations and all items necessary to construct the *Work* in conformance with the *Contract Drawings* and *Schedule of Quantities and Prices.*

2. PRODUCTS – NOT USED

3. EXECUTION – NOT USED

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Other Sections Specifying Concrete

1.2 WORK INSTALLED BUT SUPPLIED UNDER OTHER SECTIONS

.1 Install following materials specified to be supplied under other Sections of these project specifications:

.1 Fabricated components, anchor bolts, bearing plates, sleeves and other inserts to be built into concrete.

1.3 QUALITY ASSURANCE

.1 Cast-in-place concrete to conform to CSA-A23.1

.2 Testing shall conform to CSA-A23.2

.3 These standards shall be available in Contractor's site office for use of Contractor and Engineer.

1.4 REFERENCE DOCUMENTS

.1 Perform cast-in-place concrete work in accordance with the following standards except where specified otherwise.

.2 ASTM C109/C109M-most current version, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars Using 2-in. of 50-mm Cube Specimens.

.3 ASTM C295- most current version, Standard Guide for Petrographic Examination of Aggregates for Concrete.

.4 ASTM C309-most current version, Standard Specification for Liquid Membrane – Forming Compounds for Curing Concrete.

.5 ASTM C330-most current version, Standard Specification for Lightweight Aggregates for Structural Concrete.

.6 CAN/CGSB-51.34-M most current version, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.7 CAN/CSA-A3000- most current version, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.8 CAN/CSA-A23.1- most current version, Concrete Materials and Methods of Concrete Construction.

.9 CAN/CSA-A23.2- most current version, Methods of Test for Concrete.

.10 CAN/CSA-A23.1- most current version, Design of Concrete Structures.

.11 CAN/CSA G30.5- most current version, Welded Steel Wire Fabric for Concrete Reinforcement.

.12 CAN/CSA G30.14-M most current version, Deformed Steel Wire for Concrete Reinforcement.

.13 CAN/CSA G30.15-M most current version, Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

.14 CAN/CSA G30.18- M most current version, Billet Steel Bars for Concrete Reinforcement.

.15 CAN/CSA-S269.3, Concrete Formwork.

.16 CAN/CSA W186-M most current version, Welding of Reinforcing Bars in Concrete Construction.

.17 American Concrete Institute (ACI) Detailing Manual - SP-66, ACI 315, most current versions.

.18 Concrete Reinforcing Steel Institute (CRSI) – Reinforcing Steel Manual of Standard Practice.

1.5 INSPECTION AND TESTING

.1 Concrete work may be tested to CAN/CSA A23.2 or as specified herein by a testing firm retained by the Owner.

.2 Submit the following:

.1 Proposed concrete mix design.
.2 Results of petrographic examination of aggregates conforming to ASTM C295 representative of aggregates to be supplied for project, when requested by Engineer.
.3 Samples of fine and coarse aggregate, when requested by Engineer.

.3 Provide casual labour for the purpose of obtaining and handling sample materials.

.4 Advise testing firm in advance of concrete placement.

.5 Provide and maintain facilities at the site for storage of concrete test cylinders for the first 24 hours.

.6 Provide copies of mill test reports of cement and reinforcing steel as required.

.7 Secure sufficient cylinders for testing to ensure concrete quality control.

.8 Provide at least one ASTM cube test on grout used under base plates and machinery.

.9 Conduct core tests when required.

.10 Obtain Consultant's approval of reinforcing before placement of concrete commences. Refer to Section 3 for notification requirements.

.11 The testing firm may perform the following tests:

.1 Take three test cylinders from each 60 m^3 of concrete, or fraction thereof, of each type of concrete placed in any one day.
.2 Take samples of concrete mix close to the point of final deposit in the form. Contractor is required to provide suitable access to the Work for obtaining samples.
.3 Moist cure and test one cylinder in 7 days and moist cure and test the remaining two cylinders in 28 days.
.4 Take one additional test cylinder when the temperature is likely to fall below 0°C within 48 hours after placing and no provisions have been made to heat the concrete to greater than 10°C. Cure the additional test cylinder on the job-site under same conditions as concrete it represents and test in 7 days.
.5 Make at least one slump test and one entrained air test for each set of test cylinders taken.
.6 Monitor Temperature of concrete.
.7 Results of field tests will be reported immediately to the Contractor by the field representative of the testing firm. These results do not imply approval or disapproval of the work, but are for the Contractor's information. The Engineer will determine acceptability of the work.
.8 Results of concrete tests will be forwarded to the Engineer and to the Contractor. Included with the results will be the following information: Name of Project, Date of Sampling, Name of Supplier, Delivery Truck Number, Identification of Sampling and Testing Technician and exact location in the structure of the concrete sampled.
.9 Testing firm personnel are not authorized to revoke, relax, enlarge or release any requirements of the specification, nor to accept or reject any portion of the work.

1.6 SHOP DRAWINGS

.1 Submit Shop Drawings, including placing drawings for reinforcing steel and welded steel wire fabric in accordance with Division 1.

.2 Identify support and placing details of reinforcing conforming to ACI 315 and CRSI.

1.7 ACCEPTABILITY

.1 Failure to comply with the requirements which control strength and durability will result in the structure being considered potentially deficient.

.2 A structure will be considered potentially deficient when:

.1 Concrete is not as specified in Concrete Mix Schedule in this Section.
.2 Reinforcing steel size, quantity, position, quality or arrangement are not as specified or detailed.
.3 Improper curing methods or materials are used.
.4 Inadequate protection of concrete is provided from extremes of temperature during early stages of hardening and strength development.
.5 Mechanical injury occurs from fire, construction overload or premature removal of forms.
.6 Poor workmanship is evident.
.7 Placed concrete differs from the required dimensions.
.8 The Engineer has not reviewed formwork and reinforcement before concrete placement.

.3 Strength evaluation tests and analysis.

.1 The Engineer may order an independent testing firm to obtain cores, x-rays, or similar non-destructive tests.
.2 The Engineer may order a load test and/or analysis as defined by CSA-A23.3 Section 20, if the non-destructive tests are impractical or inconclusive.
.3 The Contractor shall reinforce by additional construction or replace, as directed by the Engineer at own expense, concrete judged inadequate by structural analysis or by results of load tests.
.4 The Contractor shall pay the cost of testing and/or analysis which is required to demonstrate the adequacy of the structure, which does not meet the requirements for strength, or which has been placed before formwork and reinforcing have been inspected and approved by the Engineer.
.5 The Engineer may order additional testing at any time even though the required tests indicate that the strength requirements have been met. In this instance the Engineer will pay for those tests that meet the specified requirements and the Contractor shall pay for those that do not.

.4 Concrete not conforming to the lines, detail, strength and grade specified herein or as shown on drawings shall be modified or replaced at the Contractor's expense, to the satisfaction of the Engineer.

2. PRODUCTS

2.1 CONCRETE MATERIALS

.1 Portland Cement: to CAN/CSA-A3000.

.2 Aggregates: to CSA-A23.1 and as follows:

.1 Ironstone content of aggregates in exposed interior or exterior concrete subject to intermittent or continuous wetting not to exceed the following, when tested to ASTM C295:

.1 Coarse Aggregate: maximum 1% by mass.
.2 Fine Aggregate Retained on 2.5 mm Sieve: maximum 1.5% by mass.

.3 Water: potable, to CSA-A23.1.

.4 Air Entraining Admixtures: to CSA-A23.1

.5 Chemical Admixtures: to CSA-A23.1 and as approved by the Engineer. Calcium chloride will not be permitted.

.6 Supplementary Cementing Materials: to CAN/CSA-A3000.

2.2 CONCRETE ACCESSORIES

.1 Liquid Membrane Forming Curing Compound: to CSA-A23.1-94.

.2 Grout: Non-shrink premixed types with a minimum of 30 MPa compressive strength at 24 hours.

.3 Concrete Topping: SikaTop 122 PLUS.

.4 Bonding Agent: High polymer resin emulsion mixed with cement mortar or grout to form a water resistant adhesive bond.

.5 Control Joint Sealant: Sikaflex 2C SL (Horizontal), Sikaflex 2C NS (Vertical)

.6 Waterstops: Extruded polyvinylchloride with center-bulb and ribbed flanges, 150 mm x 5 m unless noted otherwise, factory-made corners and tees: Type 788C by Greenstreak, Durajoint Type 5A by Sternson Construction Products, or approved equivalent. Voclay WATERSTOP-RX complete with WB-ADHESIVE.

.7 Dampproof Membrane: 250 micrometre polyethylene film (10mil) to CAN/CGSB-51.34.

2.3 REINFORCING MATERIALS

.1 Reinforcing Steel: to CSA G30.18 400 MPa yield grade deformed billet steel bars except for beam stirrups and column ties use only 300 MPa yield grade or 400 MPa yield grade to CSA G30.18.

.2 Reinforcing Steel: to CSA G30.18, 400 MPa yield grade special low alloy deformed billet steel for welding and/or bending.

.3 Welded Steel Wire Fabric: to CSA G30.5.

.4 Chairs, Bolsters, Bar Supports, Spacers: to CSA A23.1, adequate for strength and support of reinforcing. Non-corrosive and non-staining where specified.

.5 Fibre reinforcing: Fibres shall be polypropylene with a tensile strength of 550 MPa minimum. The fibre lengths 38 mm applied at 1.9 kg/cu. M.:

Max. Aggregate Size	Fibre Length
40 mm	50 mm
25 mm	50 mm
19 mm	38 mm

2.4 FORMWORK MATERIALS

.1 Formwork: design to CSA A23.1, CSA S269.1, ACI 347, and all applicable construction safety regulations for the place of work. Formwork to be free of bends, dents and residual concrete, well matched, tight fitting and adequately stiffened to support concrete weight without deflection detrimental to appearance of finished concrete surfaces.

.2 Form Ties:

.1 Concrete without special architectural features: use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. Non-corrosive and non-staining at surfaces where concrete will be exposed.

.3 Form Oil: non-staining and non-volatile type.

.4 Void Forms: low density bead board; structurally sufficient to support weight of wet concrete mix until initial set; thickness noted on Drawings.

.5 Falsework materials: to CSA-S269.1.

2.5 MIX

.1 Supply concrete mix proportioned to produce concrete specified in Concrete Mix Schedule.

.2 For requirements not specified in Schedule, conform to CSA A23.1.

.3 Use of admixtures, other than air-entraining admixtures, are not permitted without prior approval of the Engineer.

2.6 FABRICATION OF CONCRETE REINFORCEMENT

.1 Fabricate reinforcing steel in accordance with CSA A23.1, ACI 315 and the (CRSI) Reinforcing Steel Manual of Standard Practice.

.2 Obtain Engineer’s approval for locations of reinforcing splices other than those shown on placing drawings.

.3 Upon approval of Engineer, weld reinforcing steel in accordance with CSA W186.

.4 For Hooks, Bends, Laps and Similar Details conform to ACI Detailing Manual SP-66.

.5 Dowel columns and walls into foundations using same reinforcing as in column and wall unless noted otherwise in the Contract Documents.

.6 Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars or welded wire fabric around wall and grade beam corners.

.7 Provide 10M stirrup support bars in hooks or corners of beam stirrups unless noted otherwise in the Contract Documents.

.8 Provide 4 extra 15M diagonal corner bars around holes larger than 100 mm in floor slabs and walls. Provide corner bars 1.5 times the length of shortest side of hole or minimum 750 mm long.

.9 Provide one 15M bar each face for holes larger than 1000 mm in walls.

.10 Cover electrical conduit, ductwork or piping buried in slabs with 600 mm wide strip of 102 x 102 x MW13.3 x MW13.3 welded wire fabric. When principal slab reinforcement is placed above conduit then place 600 mm strip under conduit. Position of reinforcing steel takes precedence over conduit, ductwork or piping.

3. EXECUTION

3.1 PREPARATION

.1 Obtain Engineer’s approval before placing concrete. Provide Engineer and testing agency 2 working days notice prior to placing concrete.

.2 Coordinate placement of waterstops, inserts and joint devices with erection of concrete formwork and formwork accessories.

.3 Pumping of concrete is permitted only after approval of equipment, mix, and additives.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Prior to placing concrete obtain Engineer’s review of method for protection of concrete during placing and curing [in adverse weather] and in conformance with CSA-A23.1.

.6 If the Engineer finds any portion of the preparation is not in conformance with the Contract Documents and/or good workmanship, the Contractor shall rectify the deficiency and no concreting shall be done until the deficiency is rectified.

3.2 FORMWORK

.1 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.

.2 Apply form release agent in accordance with manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices and embedded parts.

.3 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.

.4 Fabricate and erect falsework in accordance with CSA-S269.1.

.5 Do not place shores and mud sills (if required) on frozen ground.

.6 Provide site drainage to prevent washout of soil supporting shores and mudsills.

.7 Align form joints and make watertight. Keep form joints to a minimum.

.8 Use 25 mm chamfer strips on external corners and 25 mm fillets at interior corners of concrete members, unless specified otherwise.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including paint.

.11 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings in bottom of forms to allow flushing water to drain.

.12 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs and to provide uniform surface on exposed concrete.

3.3 INSERTS, EMBEDDED ITEMS, AND OPENINGS

.1 Provide formed openings where required for pipes, conduits, sleeves or other work to be embedded in and passing through concrete members. Obtain Engineer's approval before framing openings not shown on drawings.

.2 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated on Structural Drawings or approved by the Engineer.

.3 Do not cut, bend, eliminate or displace reinforcement to accommodate sleeves, ducts, pipes and embedded items. If these cannot be located as specified, obtain approval of modifications from the Engineer before placing of concrete.

.4 Check locations and sizes of sleeves and openings shown on drawings. Accurately locate and set in place items which are to be cast directly into concrete. Coordinate installation of concrete accessories.

.5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.6 Conduit and pipe embedded in concrete shall:

.1 Not displace more than 4% of the cross sectional area of a column, including the area of concrete displaced by the bending of the conduit, or the exit path of the conduit out of the column.
.2 Not exceed one-third of the solid portion of the slab thickness.
.3 Not be spaced closer than three diameters on centre.
.4 Have a minimum concrete cover of 25 mm.

3.4 ANCHOR BOLTS AND BASE PLATES

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete. “Wet placement” of anchor bolts is not acceptable.

.2 Grout under base plates and machinery]using procedures in accordance with manufacturer’s recommendations which result in 100% contact over grouted area.

3.5 WATERSTOPS

.1 Not Applicable.

3.6 FORM REMOVAL

.1 Contractor to provide proposed form removal schedule.

.2 Leave formwork in place for following minimum periods of time after placing concrete or as otherwise directed by the Engineer for specific locations.

.1 Seven days for walls, sides of beams, and columns, **or** three days if a strength test indicates that 60% of the 28 day compressive design strength is achieved.
.2 Fourteen days for beam soffits, slabs, decks and other structural members, or seven days when replaced immediately with adequate shoring to standard specified for falsework and a seven day strength test indicates that 70% of the 28 day compressive design strength is achieved.
.3 Two days for footings and abutments.
.4 Where forms are providing curing protection, they shall be left in place a minimum of seven days.
.5 Foundation walls retaining earth on one side. The greater of 7 days or when 70% of 28-day design strength is reached.

.6 Foundation walls retaining earth on both sides. The greater of 3 days or when 60% of 28-day design strength is reached.

.3 Remove falsework progressively, in accordance with CSA 269.1 and ensure that no shock loads or unbalanced loads are imposed on the structure.

.4 Loosen forms carefully. Do not wedge pry bars, hammers or tools against finish concrete surfaces scheduled for exposure to view.

.5 Do not place load upon or against new concrete until authorized by the Engineer.

3.7 RESHORING

.1 Prepare a schedule of reshoring and submit to Engineer for review.

.2 Reshore structural members where required due to design requirements or construction conditions. Remove load supporting forms only when concrete has attained 80 percent of required 28-day strength and reshore.

.3 Install reshoring as required to permit progressive construction.

.4 If a concrete floor is supporting shoring for the floor above, forms for the bottom floor shall be left in place not less than 28 days.

3.8 PLACING REINFORCING STEEL

.1 Place reinforcing steel as indicated on reviewed shop drawings and in accordance with CSA A23.1.

.2 Prior to placing concrete, obtain Engineers approval of reinforcing and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

.4 Do not field bend or field weld reinforcement, except where indicated in the Contract Documents or as authorized by the Engineer.

.5 Remove all loose scale, loose rust and other deleterious matter from surfaces of reinforcing.

.6 Place reinforcement within a tolerance of ±6 mm for slab steel and to within ±12 mm for other steel. Locate bends and end of bars within 50 mm of specified location.

.7 Place reinforcing steel to provide concrete cover to the most stringent requirements of either the minimum requirements of CSA A23.1, as indicated elsewhere in the Contract Documents, or as follows:

Item	Cover (mm)
Beam Stirrups	40
Supported Slabs and Joists	20
Column Ties	40
Interior Walls not exposed to weather or backfill	25
Walls Exposed to weather or backfill	50
Footings and concrete formed against earth	75
Slabs on Fill	50

.8 Where a structural concrete member is required to have a fire resistance rating, provide minimum concrete cover to reinforcing steel in accordance with Appendix B of the Alberta Building Code, except where indicated otherwise in the Contract Documents.

.9 Provide 10M "U" spacers at 3 m on centre horizontally and 1.5 m on centre vertically to hold wall reinforcing mats in position.

.10 Provide non-corrosive and non-staining reinforcing steel supports at surfaces where concrete will be exposed.

.11 Support welded wire mesh and reinforcing steel in slabs on grade, using concrete bricks or high chairs located at maximum 1 m on centre each way.

.12 Placing reinforcing on or in layers of fresh concrete as the work progresses is not permitted.

3.9 PLACING CONCRETE

.1 Perform concrete work in accordance with CAN/CSA-A23.1.

.2 Place concrete as a continuous operation stopping only at construction joints indicated on the drawings or as follows:

.1 At center of span of suspended slabs, beams and joists;
.2 in walls and columns immediately above or below floor construction;
.3 At center of steel beam that supports concrete slab.

.3 Construction joints at center of span of suspended slabs beams and joists shall be adequately doweled and keyed.

.4 Place floor slabs on grade as one continuous pour between construction joints indicated on drawings. Control joints for each pour shall be formed by sawing a continuous 25 mm deep slot at 6 m centers each way unless otherwise indicated on drawings. Sawing shall be done as soon as the concrete has sufficiently hardened to prevent raveling of the edges but in no case later than 24 hours after the concrete slab has been placed.

.5 Isolate slabs on grade from vertical concrete using pre-moulded joint fillers extending from bottom of slab to within 12 mm of slab surface unless otherwise indicated.

.6 Use winter concreting methods in accordance with CAN/CSA A23.1 when the mean daily temperature falls below 5°C.

.7 Use procedures noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surfaces are not damaged.

.8 Vibrate concrete using the appropriate size equipment as placing proceeds in strict accordance with Clause 19.5 of CSA-A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.9 Do not place concrete if carbon monoxide producing equipment has been in operation in the building during the 12 hours preceding the pour. This equipment shall not be used during placing, or for 24 hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or by an impermeable membrane from direct exposure to carbon monoxide, combustion gases or drying from heaters.

.10 Honeycomb or embedded debris in concrete is not acceptable. Honeycombed areas discovered after the removal of the forms shall not be repaired until inspected by the Engineer. Where honeycombing has occurred, the corrective method of treatment shall be carried out as directed by the Engineer.

.11 Remove and replace concrete deemed to be defective by the Engineer.

.12 Revise, re-seat and correct improperly positioned reinforcing, immediately before placing concrete.

.13 Maintain accurate records of poured concrete items to indicate date, location of pour, quality of concrete, ambient air temperature and test samples taken.

3.10 FINISHING FORMED SURFACES

.1 Rough Form Finish Concrete Surfaces not Exposed to View: in accordance with CSA A23.1. Place concrete against forms reasonably true and plane. Cut off form ties a minimum of 10 mm below concrete surface. Patch tie holes and defects. Remove fins exceeding 5 mm.

.2 Smooth Form Finish Concrete Surfaces Exposed to View: in accordance with CSA A23.1. Place concrete against plywood, steel or tempered hardboard. Patch tie holes and defects. Remove fins.

.3 On all surfaces, cavities produced by form ties, air bubbles, all other holes, broken edges or corners and all other defects shall be repaired. The resulting surfaces shall be true and uniform.

3.11 FINISHING FLATWORK

.1 Light broom finish on exterior pads.

3.12 TREATMENT OF SLAB OR FLOOR SURFACES

.1 Not Applicable.

3.13 CURING AND PROTECTION

.1 Initial Curing: Keep concrete surface continuously moist until concrete temperature has dropped several degrees.

.2 Final Curing: Immediately following initial curing and before the concrete has dried cure for an additional seven days. During that time, ensure that the temperature of the air in contact with the concrete is above 10°C.

.3 Acceptable Curing Methods:

.1 Ponding or continuous sprinkling.
.2 Absorptive mat or fabric kept continuously wet.
.3 Damp sand, earth, or similar moist material.
.4 Continuous steam vapour mist bath not exceeding 66°C.
.5 Curing compound, except where chemical hardener is to be used.
.6 Waterproof paper or plastic film
.7 Forms in contact with the concrete surface and left in place for 7 days.

.4 Do not use curing compounds on concrete surfaces to receive topping or other type of bonded finish unless approved by the Engineer.

.5 Protect freshly placed and consolidated concrete against damage or defacement from adverse weather conditions.

.6 Exposed Concrete Walking Surfaces Not to Receive an Integral Hardener: Coat with curing compound of type that provides permanent seal.

.7 Provide appropriate cold weather protection as specified in CSA A23.1.

3.14 COLD AND HOT WEATHER CONCRETING

.1 Conform to the requirements of CSA A23.1.

.2 Protect slabs being finished during drying conditions above 25° C, and/or during high winds with moisture retention film.

3.15 DAMPPROOF MEMBRANE

.1 Place dampproof membrane on prepared sub-grade under slabs on grade. Lap each sheet minimum 150 mm. Seal laps and penetrations using materials recommended by membrane manufacturer.

3.16 GROUT

.1 Mix grout to flowable consistency and apply in accordance with manufacturer's instructions.

3.17 EQUIPMENT PADS

.1 Provide concrete pads for equipment where indicated on drawings. Adjust dimensions of pads to reviewed shop drawings.

.2 Insert bolts and sleeves and pack with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel surfaces smooth. Chamfer exposed edges.

3.18 CONCRETE MIX SCHEDULE

Component	Type	Min. Comp. Strength @ 28 Days (MPa)	Exposure Class	Air Content Category	Slump Range* (mm)	Nominal Aggregate Size (mm)
Interior Structural Slabs And Slabs-on-grade	GU	25	N	None	50-80	20-5
Exterior Slabs-on-grade	HS	32	F-2	2	50-80	20-5

*Subject to Engineer's prior written approval, maximum slump may be increased beyond specified range by the use of chemical admixtures, except for zero slump mixes.

**Fly-ash to a maximum of 20% of cementitious content by weight may be substituted for cement content, subject to Engineer’s approval.

END OF SECTION

1. GENERAL

1.1 INTENT

.1 This section refers to the supply and installation of a kiosk.

.2 Refer to structural, process, and electrical drawings for layout, dimensions, installation, and equipment to be incorporated.

1.2 PERFORMANCE REQUIREMENTS

.1 The kiosk shall include structural bracing to accommodate transportation, wind, snow and ice loading.

.2 Kiosk manufacturer shall be responsible for obtaining structural certification from APEGBC registered professional engineer.

.3 The Kiosk and it's anchors are be constructed to meet the Seismic requirements of the BCBC 2018 and the Seismic Design Data for Qualicum Beach BC as per Table C-3 in the BCBC.

Qualicum Beach BC:
$S_a(0.2)=0.888$
$S_a(0.5)=0.838$
$S_a(1.0)=0.517$
$S_a(2.0)=0.323$
$S_a(5.0)=0.108$
$S_a(10.0)=0.038$
PGA: 0.395
PGV: 0.629

1.3 SUBMITTALS

.1 Detailed shop drawings including plans, elevations, sections, and details shall be submitted to the engineer for review prior to production.

2. PRODUCTS

2.1 KIOSK

.1 Free standing three section multi door enclosure including the following features:

.1 Marine grade aluminum construction
.2 CSA Type 3R rated
.3 Free standing enclosure
.4 Pad mount design
.5 Peaked roof with rain gutter
.6 Hinged doors with hidden hinges and pour in place gasket
.7 Gas shock door stays
.8 Pad lockable stainless steel 3-point handles

.9 Removable lifting ears
.10 Powder coated ASA61 Grey finish
.11 Insulation of outer shell
.12 Galvanized or painted back panel in each section
.13 LED strip lighting in each section for full width
.14 Lighting controlled by door switch on primary door of the section

.2 Acceptable manufacturers: Valid Manufacturing Ltd., Code Electric Products Ltd., or approved alternative.

3. EXECUTION

3.1 INSTALLATION

.1 Install kiosk according to manufacturer's instructions.

.2 Set kiosk plumb and aligned.

.3 Fasten kiosk securely to concrete pad with anchor bolts.

.4 Seal between kiosk and concrete pad to prevent ingress of moisture.

3.2 CLEANING

.1 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable by sealant manufacturer.

.2 Clean all surfaces.

3.3 PROTECTION

.1 Provide protection to finished surfaces with strippable coatings, strippable wrappers, plywood or sheet materials as required before acceptance of work.

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings in accordance with Section 5.0 of General Conditions.

.2 Closeout Submittals:

.1 Submit operations and maintenance data for incorporation into manuals specified in Section 01 33 01 – Project Record Documents.

1.2 QUALITY ASSURANCE

.1 Provide factory assembled, package type unitary air conditioning unit, product of manufacturer regularly engaged in production of unit of type and size specified, who issues complete catalogue data on such products.

2. PRODUCTS

2.1 TYPE

.1 Provide self-contained, packaged, factory assembled, prewired unit, consisting of exterior surface mounted cabinet, supply fan, exhaust fan, rain hood, filters and controls.

2.2 CABINET

.1 Cabinet shall be stainless steel, equipped with mounting gasket to maintain NEMA/TYPE 4.

.2 Pressure test to ensure liquid tight seal.

2.3 AIR FILTERS

.1 Provide inlet air-filter kit.

2.4 CONTROLS

.1 Factory wired controls shall include contactor, temperature controller, read-out integration with PLC.

3. EXECUTION

3.1 INSTALLATION

.1 Install as per manufacturer recommendations in location and mounting height as shown on drawings.

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

.1 Shop Drawings:

.1 Submit shop drawings in accordance with Section 5.0 of General Conditions.

.2 Closeout Submittals:

.1 Submit operations and maintenance data for incorporation into manuals specified in Section 01 33 01 – Project Record Documents.

1.2 QUALITY ASSURANCE

.1 Terminal heat transfer units shall be product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

2. PRODUCTS

2.1 GENERAL

.1 Factory apply baked primer coat on metal surfaces of enclosure or cabinet.

2.2 FAN HEATERS

.1 Heating Elements: Tubular heating element with fins.

.2 Cabinet: White epoxy powder paint, 18-gauge steel front cover, bottom air outlet.

.3 Closed, factory-lubricated motors. 160 cfm fan.

.4 Fan delay purge for residual heat.

.5 Wiring: Factory installed, CSA approved.

3. EXECUTION

3.1 INSTALLATION

.1 Install as per manufacturer specifications at mounting location and height noted on drawings.

END OF SECTION

1. REGULATORY REQUIREMENTS

.1 Comply with Safety Codes Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code.

.2 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the edition of the Canadian Electrical Code, Part I, CSA C22.1, and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.

.3 All electrical products shall be tested, certified and labeled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labeled, provide written approval by the authority having jurisdiction.

.4 Submit to authority having jurisdiction and Utility Company, necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees.

.5 Submit to Owner, copy of electrical permit obtained from authority having jurisdiction.

.6 If authority having jurisdiction conducts an electrical inspection, submit copy of certificate of acceptance provided by authority having jurisdiction.

2. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 Submit shop drawings, product data and samples, as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials.

3. OPERATION AND MAINTENANCE DATA

.1 Provide the following for all systems and components:

.1 Manufacturer's product data, including performance curves and schematic and wiring diagrams for all electrical control systems.

.2 Manufacturer's installation instructions.

.3 Manufacturer's operation instructions.

.4 Manufacturer's maintenance instructions, including complete parts list for all serviceable components.

.2 Provide a comprehensive list of Subcontractors, Sub-subcontractors and suppliers who supplied and installed systems and components.

.3 Provide copies of all inspection certification reports from authorities having jurisdiction.

4. RECORD DRAWINGS

.1 Record actual locations of all pull boxes, panelboards, luminaires, feeders, electrical equipment and electrical site services.

.2 Record any changes to circuit designations.

.3 Indicate on record drawings exact dimensioned locations of buried services and embedded or concealed conduits in floors and masonry walls. Obtain acceptance of this information by Engineer before commencing backfilling or concrete placement.

.4 Include on record drawings all revisions due to engineering change orders, site alterations, additions and field ordered changes made during construction.

5. COORDINATION

.1 Coordinate work specified in Division 26 with work specified in other Divisions. Ensure that proper arrangements and provisions are made for work specified in Division 26.

6. SOURCE OF SUPPLY

.1 All like materials shall be by a single manufacturer.

7. REFERENCE STANDARDS

.1 Comply with standards of following organizations:

.1 Electrical and Electronic Equipment Manufacturers Association of Canada (EEMAC).

.2 Institute of Electrical and Electronic Engineers (IEEE).

8. PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Product Options

.1 For products specified by Non–proprietary Specification:

.1 Select any product by any manufacturer that meets the requirements of the Contract Documents.

.2 For products specified by Proprietary Specification:

.1 Select any product or manufacturer named; or

.2 Select a substitute product or manufacturer in accordance with substitutions.

.3 For products specified by Proprietary Specification and accompanied by words indicating that substitutions will not be accepted:

.1 Select any product or manufacturer named; Substitutions will not be permitted.

.2 Substitutions

.1 Where Substitute Products are permitted, unnamed products will be authorized by the Owner, subject to the following:

.1 Substitute Products shall be the same types as, be capable of performing the same functions as, and meet or exceed the standards of quality and performance of the named product(s). Substitute Products shall not require revisions to the Contract Documents nor to work of Other Contractors.

.2 Do not order or install Substitutions without the Owner's authorization.

.3 If, in the Owner's opinion, a Substitution does not meet the requirements of the Contract Documents, provide a product that, in the Owner's opinion, does meet the requirements of the Contract Documents.

.3 Changes to Authorized Products and Manufacturers

.1 Do not change products or manufacturers, authorized by the Owner for use in performance of the Work, without the Owner's written authorization.

9. DISCONNECTS

.1 Disconnects: to CAN/CSA C22.2 No.4-M89, heavy duty, lockable, non-fused, with poles, voltage, amperage, kw ratings and enclosures as indicated on drawings and required by CEC to suit application.

10. SUPPORTING DEVICES

.1 Provide metal brackets, frames, clamps, channels, straps and related devices to adequately support weight of equipment and raceways.

11. TESTING

.1 Prior to energizing any portion of the electrical system, perform megger tests on all parts of the distribution system. Results shall meet the requirements of the CEC, authority having jurisdiction and the Contract Documents.

END OF SECTION

1. GENERAL

.1 Not Applicable

2. PRODUCTS

2.1 BUILDING WIRING

.1 Building Wiring: to CSA C22.2 No. 75-M1983 and as follows:

.1 Conductors: solid copper for No. 14 AWG and smaller, stranded copper for No. 12 AWG and larger.

.2 Insulation: RW90 X-link.

.3 Insulation Rating: 600V.

.4 Sizes: as indicated in Wire Size Schedule.

2.2 CABLES

.1 Type TECK 90 Cable: to CSA C22.2 No. 131-M89 and as follows:

.1 Conductor: copper.

.2 Insulation: cross linked polyethylene (XLP).

.3 Rating: 600V.

.4 Size: as indicated.

.5 Configuration: as indicated.

.6 Inner Jacket: PVC -40°C.

.7 Armour: aluminum.

.8 Outer Jacket: PVC -40°C.

.2 Control Cable for Class 2 Remote Control and Signal Circuits:

.1 Conductor: copper.

.2 Insulation: 300 V insulation, rated 60°C.

.3 Configuration: individual conductors twisted together, foil shielded, and covered with a PVC jacket.

2.3 CONNECTORS

.1 Provide factory fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated.

3. EXECUTION

3.1 WIRING, GENERAL

.1 Wires shall not be spliced unless approved by the Engineer. Splices can only be made in junction or outlet boxes.

.2 Conductor length for parallel circuits shall be identical.

.3 Neatly train and lace conductors inside cabinets, equipment and panelboards.

3.2 WIRING INSTALLATION IN RACEWAYS

.1 Swab raceway system before installing wiring.

.2 Use pulling lubricant for conductors No. 4 AWG and larger.

3.3 WIRE CONNECTIONS AND TERMINATIONS

.1 Use solderless pressure connectors with insulated covers for copper wire splices and taps, No. 8 AWG and smaller.

.2 Use insulated spring wire connectors with plastic caps for conductors No. 10 AWG and smaller.

.3 Use split bolt connectors for copper wire splices and taps, No. 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150% of insulation value of conductor.

3.4 WIRE SIZE SCHEDULE

.1 Lighting Circuits: No. 12 AWG minimum.

.2 Power Circuits: No. 12 AWG minimum.

.3 Motor Circuits: No. 12 AWG minimum, except as otherwise indicated on drawings or in schedules.

.4 Feeder Circuits: as indicated on drawings or in schedules.

3.5 WIRING INSTALLATION IN CABLE TRAYS

.1 All TECK cable shall be installed in cable trays as indicated on the drawings and according to the Canadian Electrical Code.

.2 All 4-20mA signal, 24VDC, 24VAC and general data cables shall be run in separate cable trays from 120VAC and higher voltage cables where possible. Where a single tray is shared, the cables shall be separated by a grounded cable tray barrier.

.3 Cables of unlike signal and voltages shall only cross each other at 90° angles.

.4 TECK cable drops to equipment shall be supported by vertical cable tray risers. Single or double TECK cable drops may be run in vertical cantruss.

.5 All power and lighting cables shall be separated in the cable tray according to the Canadian Electrical Code. It will be the responsibility of the Contractor to de-rate the conductors if the ventilation spacing requirements are not met.

END OF SECTION

1. GENERAL

.1 Not Applicable

2. PRODUCTS

2.1 MATERIALS

.1 Grounding and bonding equipment for the Bingham Crossing Potable Water Pump Station and Reservoir Equipment: to CSA C22.2 No. 41-M1987 and as follows:

.1 Ground Rods: 20 mm x 3 m copper clad

.2 Ground Wells:

.1 22GA galvanized steel construction

.2 Lift off cover

.3 Minimum 250 mm diameter and 300 mm height

.3 Ground Conductors: as specified in Section 26 05 19.

.4 Ground Grid:

.1 No of ground rods: as shown on drawings

.2 Interconnect conductors: bare copper of size as shown on drawings

.3 Ground conductors to system neutral point: bare copper of size as shown on drawings.

3. EXECUTION

3.1 INSTALLATION

.1 Comply with requirements of CSA C22.2 No. 0.4-M1982 and Canadian Electrical Code.

.2 Install complete permanent grounding system including electrodes, conductors, connectors and accessories.

.3 Protect exposed ground conductors from mechanical injury.

.4 Make buried connections, and connections to electrodes using pressure connectors.

.5 Make connections within ground wells where possible.

.6 Use mechanical connectors for ground connection to equipment provided with lugs.

.7 Do not solder joints.

.8 Install bonding wire in flexible metal conduit connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.

.9 Install separate insulated ground conductor in conduit runs installed in concrete which is subject to moisture penetration and underground.

.10 Install a separate insulated ground conductor in all conduit runs.

3.2 SYSTEM GROUNDING

.1 Provide ground grid with one ground conductor from grid through the system neutral point to the main ground bus bar.

.2 Provide ground conductor from steel piping headers to ground grid.

.3 Provide ground conductor from gas pipe to ground grid.

.4 Provide ground conductor from control panel isolated ground to nearest ground rod of ground grid.

3.3 GROUND CONDUCTORS

.1 Use bare ground conductors for the following:

		Size
.1	Service Entrance	see drawings
.2	Telephone Service Entrance	#6

.2 Use green insulated ground conductors for the following:

		Size
.1	Circuit Ground Conductors	#12
.2	Bonding Jumpers	#1
.3	Gas Pipe Grounding	#1
.4	Lightning Arrestor	#6
.5	Control Panel Instrument Ground	#6

END OF SECTION

1. GENERAL

1.1 COORDINATION

.1 Coordinate with other work including wire and cable, boxes and fittings and panel work, as necessary to interface installation of conduit with other work.

.2 Coordinate installation of conduit in concrete with concrete work specified other Divisions.

.3 Coordinate installation of conduit which penetrates fire rated walls, floors and ceilings with firestopping work specified in other Divisions. Ensure that integrity of the fire rated element is maintained.

2. PRODUCTS

2.1 CONDUIT, GENERAL

.1 Except where otherwise required by Canadian Electrical Code (CEC), provide conduit of types specified in Conduit Installation Schedule and sizes indicated on drawings or specified.

.2 Conduit embedded in concrete floors shall be maximum 50 mm size.

.3 Where sizes are not indicated, select proper sizes to suit intended use, fulfill wiring requirements, and comply with Canadian Electrical Code (CEC).

2.2 METAL CONDUIT AND TUBING

.1 Rigid Metal Conduit: to CSA C22.2 No. 45-M1981, and as follows:

.1 Galvanized Rigid Steel Conduit: zinc coated steel.

.2 Fittings: same material as conduit.

.2 Flexible Metal Conduit: to CSA C22.2 No. 56-1977, and as follows:

.1 Liquid-Tight Flexible Metal Conduit: continuous interlocked and double-wrapped steel, zinc coated inside and outside, coated with liquid-tight jacket of flexible PVC, minimum 12 mm diameter.

.2 Liquid-Tight Flexible Metal Conduit Fittings: cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings.

.3 Miscellaneous Fittings: locknuts, bushings, reducers, chase nipples, 3 piece unions, split couplings, plugs, and expansion fittings specifically designed for their particular application.

2.3 NON-METALLIC CONDUIT

.1 Rigid PVC (Unplasticized) Conduit: to CSA C22.2 No. 211.2-M1984.

3. EXECUTION

3.1 INSTALLATION OF CONDUIT, GENERAL

.1 For existing building and new pre-fabricated buildings, conduit shall be surface mounted on walls and ceilings.

.2 Conduit system shall be weatherproof in areas with process piping.

.3 EMT with raintight fittings will be allowed where it is not subject to mechanical injury such as along walls and above 1200 mm from walkway surface. Where a conduit may be stepped on or bumped during typical operation and maintenance, rigid metal conduit shall be used.

.4 Conduit shall be rigid pipe with proper support. The final 500 mm conduit connection into field instruments and equipment shall be liquid tight flexible metal. This is to allow easy disconnection and replacement of the device when required.

.5 Plug conduit ends to prevent entry of dirt and moisture.

.6 Seal conduit with duct seal compound or fiberglass where conduit leaves heated area and enters unheated area.

.7 Provide necessary flashing and pitchpockets, making watertight joints where conduit passes through roof or waterproofing membranes.

.8 Where conduit crosses building expansion joints, install expansion fitting approved by authority having jurisdiction, complete with grounding jumper. Provide bend or offset in conduit adjacent to building expansion joint where conduit is installed above suspended ceilings.

3.2 INSTALLATION OF RIGID METAL CONDUIT

.1 Cut conduit straight, properly ream, cut threads and brush threads clean.

.2 Fasten conduit terminations in sheet metal enclosures with two locknuts and terminate with bushing. Install locknuts inside and outside enclosure.

.3 Conduit installed underground shall be painted with two coats of corrosion inhibiting compound before backfilling.

3.3 INSTALLATION OF LIQUID TIGHT FLEXIBLE METAL CONDUIT

.1 Liquid tight conduit is only to be installed for the final connection to instruments and equipment.

.2 The length of liquid tight conduit shall be limited to two meters unless otherwise noted in the specifications or drawings.

3.4 INSTALLATION OF NON-METALLIC CONDUIT

.1 Make field bends and solvent cemented joints in accordance with manufacturer's instructions.

3.5 INSTALLATION OF EXPOSED AND SEMI-CONCEALED CONDUIT

.1 Comply with the following when installing conduit exposed in service areas, unfinished areas, finished areas, and in accessible spaces behind ceilings, walls and floors:

.1 Install conduit to conserve headroom and cause minimum interference in spaces through which conduit passes.

.2 Install conduit so as not to interfere with ceiling inserts, luminaires or ventilation ducts or outlets.

.3 Alter routing to avoid structural obstructions, keeping crossovers to a minimum.

.4 Install exposed conduit and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls and structural members.

.5 Run conduit for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.

3.6 INSTALLATION OF CONDUIT IN CONCRETE SLABS

.1 Place conduit between bottom reinforcing steel and top reinforcing steel.

.2 Separate conduit by not less than diameter of largest conduit to ensure proper concrete bond.

.3 Ensure minimum 20 mm concrete cover.

END OF SECTION

1. GENERAL

1.1 COORDINATION

.1 Coordinate with other divisions for placement of boxes.

2. PRODUCTS

2.1 METAL OUTLET BOXES

.1 Outlet boxes: to CAN/CSA-C22.2 No. 18-92 and as follows:

.1 Sheet Steel Boxes: pressed sheet steel, galvanized, blanked for conduit, integral locating lugs.

.2 Cast Boxes: corrosion resistant cast aluminum, factory threaded hubs, weatherproof.

2.2 NON-METALLIC OUTLET BOXES

.1 Outlet boxes: to CAN/CSA-C22.2 No. 85-M89 and as follows:

.1 Same as sheet steel boxes, except of rigid PVC material.

2.3 PULL AND JUNCTION BOXES

.1 Surface mounted pull and junction boxes: to CSA C22.2 No. 40-M1989 and as follows:

.1 Type: NEMA 4

.2 Material: 14 gauge steel, continuously welded seams ground smooth

.3 Covers: screw-on, closed cell, oil resistant neoprene gasket, stainless steel screws and clamps on four sides of cover to assure water tight seal.

.4 Barriers: where indicated and required

.2 Recessed pull and junction boxes or surface mounted boxes in areas above 3000AFF: to CSA C22.2 No. 40-M1989 and as follows:.

.1 Material: sheet steel

.2 Covers: screw-on

.3 Barriers: where indicated

2.4 BUSHINGS, KNOCKOUT CLOSURES, AND LOCKNUTS

.1 Bushings, Knockout Closures and Locknuts: to CAN/CSA-C22.2 No. 18-92, corrosion resistant.

2.5 AIR/VAPOUR HATS

.1 Air/vapour Hats: polyethylene, minimum 0.40 mm thick, with minimum 25 mm wide flanges, designed to be installed over electrical boxes and provide an effective air/vapour seal.

3. EXECUTION

3.1 OUTLET BOX INSTALLATION

.1 Provide boxes where indicated and as required for:

.1 Splices.

.2 Taps.

.3 Wire pulling.

.4 Equipment.

.5 Device location.

.2 Install boxes flush mounted were applicable.

.3 Except where otherwise indicated, install boxes for vertical mounting of devices.

.4 Support boxes independent from conduit.

.5 Use metal outlet boxes, except in following locations where non-metallic outlet boxes shall be used:

.1 Where subject to moisture or corrosive material.

3.2 LOCATION OF WALL OUTLET BOXES

.1 Outlets are indicated on drawings schematically. Consider locations indicated as approximate. Verify locations prior to rough in.

.2 Confirm size and location of equipment supplied and installed under other Sections, prior to rough in.

.3 Do not install boxes back to back. Allow minimum:

.1 150 mm separation in conventional walls.

.2 600 mm separation in acoustic rated walls.

.4 Position boxes in masonry walls to suit masonry course lines.

.5 Except where otherwise indicated, mount boxes at following heights:

.1	Local switches:		1200 mm
.2	Receptacles:		
	.1	General:	300 mm
	.2	Above counters:	150 mm
	.3	Above baseboard heaters:	200 mm
	.4	Utility rooms:	1200 mm
.3	Telephone/data outlets:		
	.1	General	300 mm
	.2	Beside local receptacle box	
	.3	Wall Mounted Speakers	2500 mm
.4	Fire Alarm:		
	.1	Pull Stations	1400 mm
	.2	Bells/Horns/Strobes/Combinations	2500 mm
.5	Local Emergency Battery Receptacle:		2400 mm

.6 Measure mounting height from finished floor to center line of device.

.7 Owners representative reserves the right to change location of outlets prior to installation with no change in Contract Price, provided that distance does not exceed 3 m from originally indicated location.

3.3 PULL AND JUNCTION BOX INSTALLATION

.1 Locate above accessible ceilings and in unfinished areas.

.2 Locate so as to minimize need for access doors.

.3 Support boxes independent from conduit.

3.4 AIR/VAPOUR HAT INSTALLATION

.1 Install air/vapor hats around electrical boxes located in walls and ceilings.

END OF SECTION

1. GENERAL

1.1 COORDINATION

.1 Coordinate with other work, including wire and cable, boxes and fittings and panel work, as necessary to interface installation of electrical raceways and components with other work.

.2 Coordinate installation of cable trays which pass through fire rated walls, floors or ceilings with fire stopping work.

1.2 WORK INCLUDED

.1 Design, supply and install cable tray arrangements and support fittings necessary to complete service wiring of equipment supplied by the contractor.

2. PRODUCTS

2.1 RACEWAYS, GENERAL

.1 Provide raceways of types and sizes required to handle the cable capacity with 40% spare capacity.

.2 Where not indicated, select proper types and sizes to fulfill wiring requirements and comply with Canadian Electrical Code.

2.2 CABLE TRAYS

.1 Cable trays and fittings: to CSA C22.2 No. 126-M91 and EEMAC-F5-1, and as follows:

.1 Type: Ladder with 225mm (9”) rung spacing and 150mm (6”) side rails.

.2 CSA class: D1

.3 Size: Sized to handle cable capacity with 40% spare.

.4 Material: Aluminum.

.5 Accessories and fittings: Horizontal elbows, end plates, dropouts, vertical risers and drops, tees, wyes, expansion joints and reducers, manufactured for cable tray supplied.

.6 Radii on Fittings: Minimum 300 mm.

2.3 WIREWAYS

.1 Wire ways, Auxiliary Gutters and Associated Fittings: to CSA C22.2 No. 26-1952 and as follows:

.1 Material: Sheet steel.

.2 Accessories: Elbows, tees, couplings, and hanger fittings manufactured for wire way supplied.

3. EXECUTION

3.1 INSTALLATION OF CABLE TRAYS

.1 Support cable trays with quantity of hangers, clips, support channels at all bends and tee fittings to satisfactorily carry the loads and forces encountered: CSA standard require couplers to be not located farther from support than one-quarter of the span length. Recommend support is every 3 meters.

.2 Provide cable tray grounding as to the Canadian Electrical Code. Effective grounding must be permanent and continuous, and have ample capacity to conduct any currents liable to be imposed on it.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Not Applicable

2. PRODUCTS

2.1 IDENTIFICATION MATERIALS

.1 Lamacoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:

.1 Size 1: 12 mm high with 5 mm high letters.

.2 Size 2: 20 mm high with 8 mm high letters.

.3 Size 3: 25 mm high with 12 mm high letters.

.2 Wire Identification Materials: Use only the following:

.1 Machine printed heat shrink sleeves.

.3 Colour Banding Tape: Adhesive backed plastic tape, integrally coloured.

3. EXECUTION

3.1 COLOUR IDENTIFICATION OF EQUIPMENT

.1 Electrical equipment shall be prefinished in coded colours designating voltage or system, as indicated in Equipment Identification Schedule.

.2 Voltage colour identification for line voltage equipment shall be as follows:

	Voltage	**Colour**
.1	120/208 V or 120/240 V:	Grey
.2	347/600 V:	Grey

.3 In addition to color identification of line voltage as stated in items 1&2, line voltage equipment with voltage greater than 300 volts (line to line) may be identified via clearly visible lamacoid (size 3).

3.2 NAMEPLATE IDENTIFICATION OF EQUIPMENT

.1 Identify equipment with lamacoid nameplates, as indicated in Equipment Identification Schedule.

3.3 PANELBOARD DIRECTORIES

.1 Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory.

3.4 COLOUR IDENTIFICATION OF WIRING

.1 Identify No. 2 AWG wiring and smaller by continuous insulation colour.

.2 Identify wiring larger than No. 2 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.

.3 Colour coding shall be in accordance with Canadian Electrical Code, and as follows:

	Voltage	**Colour**
.1	120/208 V, 3 phase:	Red, black and blue.
.2	120/208 V emergency:	Red, black and blue with yellow tracer.
.3	347/600 V 3 phase:	Orange, brown and yellow.
.4	347/600 V emergency:	Orange, brown and yellow with red tracer.

.4 Where multi-conductor cables are used, use same colour coding system for identification of wiring throughout each system.

.5 Maintain phase sequence and colour coding throughout each system.

3.5 COLOUR IDENTIFICATION OF WIRING

	Equipment	Size
.1	MCCs	3
.2	All compartments on MCCs	2
.3	HOA switches	1
.4	Thermostats and Dehumidstats	1
.5	All equipment and instruments, smaller than 300 mm X 300 mm X 300 mm, listed in Section 40 91 00 and P&I drawings.	1
.6	All instruments and equipment, greater than 300 mm X 300 mm X 300 mm, listed in Section 40 91 00 and P&I drawings.	2
.7	All HVAC equipment	3
.8	All Electrical Panels	2
.9	Junction boxes over 100 mm X 100 mm	1

END OF SECTION

1. GENERAL

Not Used.

2. PRODUCTS

Not Used.

3. EXECUTION

3.1 BASIC ELECTRICAL START-UP AND TESTING

.1 Energizing Main Electrical System:

.1 Prior to energizing main electrical system:

.1 Verify supply authority voltage and phase rotation.

.2 Testing of Wiring and Wiring Devices:

.1 Test conductors at distribution centers and panelboards for insulation resistance to ground (megger test).

.2 Test service grounding conductors for ground resistance.

.3 Test all wiring devices for correct operation and circuitry.

.3 Ground Resistance Testing:

.1 Measure ground resistance of ground grids with earth test megger to verify compliance with CSA C22.2 No. 0.4-M1982 and Canadian Electrical Code.

.4 Starting Motors:

.1 Prior to starting motors:

.1 Confirm motor nameplate data with motor starter heater overloads, setting of MCP's and sizing of fuses.

.2 Verify rotation.

.3 Ensure disconnects are installed.

.4 Confirm labeling of motors, disconnects and starters.

3.2 MOTOR CONTROL CENTRES

.1 Ensure all starters are properly labeled prior to testing.

3.3 STANDBY POWER GENERATION SYSTEM

.1 Factory Testing: See Section 26 32 13.0

.2 Starting Standby Power Generation System:

.1 Prior to energizing power generation units on site:

.1 Ensure generating system is disconnected from normal power supply.

.2 Ensure all auxiliary support devices are operational, including ventilation and exhaust systems.

.3 Ensure that engine has proper lubricant levels, coolant levels and fuel supply.

.4 Ensure all testing on emergency distribution equipment and transfer switch as specified has been completed.

.3 Site Testing:

.1 Conduct Site Testing in conjunction with manufacturer and in presence of the owner representative.

.2 Simulate operation of:

.1 Automatic starting cycle.

.2 Automatic shutdown.

.3 Refer to Section 26 32 13.0 for site test duration and requirements.

END OF SECTION

1. GENERAL

1.1 PRODUCT DATA

.1 All performance and test data to meet with the Owners Representative approval, CEMA and IEEE Standards.

2. PRODUCTS

.1 Transformers:

.1 3 phase, 60 Hz, delta-Y, grounded star, air cooled type, natural circulation in ventilated metal case to CSA and CEMA standards, Class B insulation with temperature rise not exceeding 80°C for rise above 40°C.

.2 Voltages and ratings as shown on drawings.

.3 Provide four 2.5 per cent full capacity taps, two above and two below normal voltage.

2.1 MOUNTING

.1 As shown on drawings.

3. EXECUTION

3.1 NAMETAGS

.1 Provide name tags indicating full electrical data, connection diagrams, etc.

END OF SECTION

1. GENERAL

1.1 SOURCE OF SUPPLY

.1 All cabinets and enclosures larger than 300 mm square and 100 mm deep shall be by a single manufacturer.

1.2 COORDINATION

.1 Coordinate size and depth of cabinets and enclosures with systems specified in other Sections which require enclosures.

.2 Coordinate installation and identification of cabinets and enclosures with painting of mechanical and electrical work specified in others Divisions.

2. PRODUCTS

2.1 CABINETS AND ENCLOSURES

.1 Cabinets and Enclosures: to CSA C22.2 No. 40-M1989 and as follows:

.1 Material: sheet steel

.2 Finish: pre-painted

.3 Covers: hinged

.4 Hinges: concealed flush type

.5 Latches: flush lock and catch assembly

.2 Backboards for Mounting of Cabinets and Enclosures: as specified in other Divisions.

3. EXECUTION

3.1 INSTALLATION

.1 Install surface or flush mounted cabinets at locations and heights indicated on drawings.

END OF SECTION

1. GENERAL

1.1 SOURCE OF SUPPLY

.1 Each of the following shall be by a single manufacturer:

.1 Switches.

.2 Receptacles.

.3 Cover plates.

1.2 COORDINATION

.1 Coordinate installation of wiring devices and cover plates with site painting and finishing work specified in other Divisions.

2. PRODUCTS

2.1 SWITCHES

.1 Switches to CSA C22.2 No. 111-M1986 and as follows:

.1 Rating: except where otherwise indicated or specified, 15 A 125/277V, full load rated for fluorescent and 80% for motor load.

.2 Type: single pole, three-way or four-way as indicated.

.3 Operation: toggle, quiet action.

.4 Features:

.1 Totally enclosed, 2-piece phenolic case.

.2 Large silver cadmium oxide contacts.

.3 Rust resistant continuous steel mounting strip.

.4 Captive mounting screws.

.5 Large head terminal screws.

2.2 RECEPTACLES

.1 Receptacles, plugs and similar wiring devices to CSA C22.2 No. 42-M1984.

.2 General Purpose Receptacles:

.1 Rating: 15 A, 125 V except where otherwise indicated.

.2 Configuration: 5-15R, 2 pole, 3 wire grounding.

.3 Features:

.1 Ground terminal and poles connected to continuous mounting yoke.

.2 Wiring terminals: 8 back-wired entrances, 4 side screws.

.3 Split feed operation.

.4 Nylon face.

.5 Triple wipe brass power contacts.

.3 Isolated Ground Receptacles: same as general purpose receptacles, except for the following features:

.1 Isolated ground.

.2 Orange face.

.4 Ground Fault Circuit Interrupter Receptacles: same as general purpose receptacles, except for the following features:

.1 Solid state ground fault sensing and signaling.

.2 5 milliamperes ground fault trip level.

.3 Feed-through type.

.4 Red trip indicator light.

2.3 COVER PLATES

.1 Stainless Steel: 1.0 mm thick, protective release paper, stainless steel screws.

.2 Weatherproof: Polycarbonate with reinforcing ribs, single flip lids, resilient rubber or closed cell foam urethane gasket, four mounting screws.

3. EXECUTION

3.1 INSTALLATION, GENERAL

.1 Install wiring devices as indicated and in accordance with manufacturer's written instructions.

.2 Install wiring devices only in electrical boxes which are clean.

.3 Install devices and cover plates flush and level.

.4 Provide matching male plug for all receptacles other than 15A 5-15R configuration receptacles.

3.2 REPLACEMENTS

.1 Replace all wiring devices and cover plates damaged during construction.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Start-up and commissioning.

1.2 CODES AND STANDARDS

.1 Design and construct the VFD in accordance with the applicable sections of the following standards or as modified in the specification.

.1 ANSI C84.1982 -- Voltage Ratings for Electric Power Systems and Equipment.

.2 CAN/CSA-C22.2 -- Industrial Control Equipment No. 14-M91.

.3 ANSI C37-90.1-1989 -- Guide for Surge Withstand Capability Tests.

.4 Equipment shall have CSA approval.

.5 Equipment shall comply with the electrical bylaws of the local electrical authority.

.6 Equipment shall be designed and manufactured in compliance with ISO-9001 quality standards.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01 – Submittals Section.

.2 Submit full technical data, service and parts facilities complete with manufacturer's published data.

.3 Full shop drawings to be submitted for VFD equipment, submit as a minimum.

.1 Specification and Data Sheets.

.2 Manufacturer's published warranty documents.

.3 Shop drawings showing plan and elevation views with certified overall and interconnection point dimensions.

.4 Interconnection wiring diagrams showing all external connections required; with all field wiring terminals marked in a consistent manner.

.5 Manufacturer's installation instructions.

.6 Complete programming instructions.

.7 Manufacturer's recommended spare parts.

.8 Complete parts list.

1.4 COORDINATION

.1 It shall be the responsibility of the Variable Frequency Drive manufacturer to obtain all operating data and operating characteristics of the electric motors and the pump/motor combinations as may be required to ensure that the VFD's will safely and efficiently drive the intended equipment over the full range of intended operating conditions for the expected service life of 25 years.

2. PRODUCTS

2.1 GENERAL

.1 The Contractor shall ensure full and complete coordination of the drive and motor characteristics which shall include, but not be limited to, the following:

.1 A guarantee that the drive and motor meet the load demands and acceleration requirements of the driven equipment throughout the speed range when the input voltage varies over a range of 10%; and,

.2 Ensuring complete compatibility of the drive's current limit protection with the motor thermal withstand capability.

.2 The drive shall be 97% efficient at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.

.3 Controlled acceleration and deceleration times, separately adjustable, shall be provided.

.4 Separately adjustable minimum and maximum frequency limits shall be provided.

.5 The drive shall be capable of regulating the frequency to a +-1% of the setpoint over the full input voltage and ambient temperature operating range.

.6 The vendor data shall indicate the efficiency, power factor, kW output, heat rejection and harmonic distortion of the drive 25%, 50%, 75% and 100% operating points.

.7 Audible noise levels produced by the drive shall be limited 80 dBA sound pressure at one meter, at any point throughout the operating range of the drive.

.8 The drive input shall be protected to withstand surges as defined in ANSI Std. (C37.90.1 - 1989, Guide for Surge Withstand Capability (SWC) Tests.

.9 The drive shall be capable of data communications via Ethernet/IP.

2.2 CONSTRUCTION REQUIREMENTS

.1 The drive shall be enclosed in the motor control center unless otherwise specified. Hinged, front access doors shall be provided.

.2 The drive shall be complete with cable compartments for connection of incoming and outgoing cables.

.3 When auxiliary cooling is required, the drive shall have fans and the required controls for proper operation.

.4 Front panel interface module with LCD display and entry keypad to provide the following functions as a minimum:

- .1 Drive setup parameters
- .2 Diagnostic information
- .3 Drive operating values

.5 The drive shall have, as a minimum, circuits within the drive for connection of remote signals as follows:

- .1 Hand-Off-Auto (HOA) switch. HOA to be mounted on VFD enclosure door.
- .2 Manual speed adjust device potentiometer for speed control when HOA is in “Hand”. Potentiometer to be mounted on VFD enclosure door.

.6 The drive shall provide the following signals via wiring as a minimum:

- .1 Run Status
- .2 Fault Status
- .3 Auto Status
- .4 Run Command
- .5 Frequency Command
- .6 Frequency Feedback

.7 The diagnostic system shall monitor each alarm and shutdown function and shall display the status of each point on the cubicle front panel.

.8 Terminal blocks for control, alarms, metering and diagnostics shall each be readily accessible, grouped and shall be segregated from power devices, for personnel safety.

.9 Each terminal block, fuse, control switch, circuit breaker, auxiliary switch, relay, instrument transformer and other auxiliary component shall be permanently labeled to correspond with the schematics and wiring diagrams.

.10 The shop drawing shall state what corrosion protection is provided.

2.3 PROTECTION SYSTEMS

.1 All power connections, cables and buswork shall be braced to withstand the available asymmetric short circuit current.

.2 The drive shall be equipped with a minimum of 15 ms power loss ride-through capability.

.3 The loss of AC input power longer than 15 ms shall cause the drive to shutdown in an orderly fashion, without causing pulsations in the drive or motor systems.

.4 The drive shall have the capability of being restarted with a remote signal from the PLC control system.

.5 The drive shall not be affected by radio frequencies emitted by portable radios/transmitters.

.6 The drive shall protect itself against the following as a minimum:

.1 Under/over voltage

.2 Overcurrent

.3 Over-temperature

.4 Output short circuit

.5 Output ground fault

.6 Stall

2.4 ACCEPTABLE SUPPLIERS

.1 Qualifications: service and parts facilities in the Province of Alberta with 24 hour service, experienced in installation and operation of VFD's.

.2 Drives shall be by Toshiba, Allen-Bradley/Rockwell or approved equivalent.

2.5 WARRANTY

.1 Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment.

.2 The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION

1. GENERAL

1.1 SYSTEM DESCRIPTION

.1 Provide emergency power system for supply of power in the event of failure of normal supply as indicated and in accordance with Canadian Electrical Code Section 46 and local inspection authority. System to be automatic, unattended, emergency power supply consisting of:

.1 Diesel fuel powered, electric generating unit with control panel

.2 Accessories and equipment as specified in this Specification.

1.2 DESIGN CRITERIA

.1 System to consist of complete standby power supply unit, self-contained liquid cooled, diesel engine directly coupled to ac alternator complete with fittings, connections, auxiliaries, control panels, safety devices, meters, etc. as indicated for a complete operating system.

.2 Design equipment suitable to meet the following criteria:

.1 Total Rated Load: 60 KW

.2 Voltage: 600V; Three Phase, four wire

.3 Frequency: 60 Hz

.4 Power Factor: 0.8

.5 Maximum Rotational Speed: 1800 rpm

.6 Duty Rating: Full continuous standby

.7 Performance: Automatic

.8 Elevation above sea level: 130 m

.9 Ambient temperature: -20°C to 40°C

.10 Relative humidity: 60%

.11 Mounted on slab on grade outside of building

.3 Unit must be capable of starting, attaining settled voltage and frequency limits and accepting full rated load with voltage and frequency settling to the specified steady state bands, all within 15 seconds for any temperature between -20 ^{o}C to 40 ^{o}C.

.4 Use engine manufacturer's standard, published continuous (prime) horsepower rating in assessing engine capacity and derate this rating for the specified conditions and engine driven accessories in accordance with latest revisions of ISO 3046/1.

.5 Description of generating set operation upon power failure:

.1 Automatic starting on contact closure from automatic transfer switch.

.2 When the emergency supply has reached settled voltage and frequency preset limits (adjustable) the transfer switch will transfer the load to the emergency supply.

.3 The set will continue to supply the load until utility supply returns or the set is shut down manually or under failure conditions.

.4 An adjustable time delay relay shall allow the engine to run unloaded to cool down and subsequently to shut down, ready for the next cycle.

.5 The engine shall be equipped with a key switch with the following positions: Auto-off-crank-start, key removable in auto positions only.

.6 Automatic shut down on:

.1 Overcranking

.2 Overspeed

.3 High engine temperature

.4 Low lubricating oil pressure

.5 Over and under frequency

.6 Unit to be equipped with a double wall secondary containment sub-base fuel tank which will contain fuel to support the generator set for a minimum period of 24 hours at 100% rated load. Additional criteria as follows:

.1 The above ground steel secondary containment tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code – NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines – NFPA 37 and Emergency and Standby Power Systems – NFPA 110.

.2 For normal venting the unit shall be furnished with an appropriate sized vent cap.

.3 The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than stipulated in NFPA

30 based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank.

.4 Emergency venting shall be provided for the secondary tank.

.5 There shall be a 2" NPT opening within the primary tank for fuel fill. The fuel fill shall be furnished with a lockable manual fill cap.

.6 A local fuel level indication (0-100%) shall be provided. The indication shall be visible from the fuel fill location.

.7 A fuel level transmitter capable of providing a 4-20mA DC signal for remote indication shall be provided. The transmitter shall be capable of 0-100% of fuel level.

.8 A low fuel level switch shall be provided for remote annunciation.

.9 A leak detection switch shall be provided for remote annunciation of the presence of fuel in the secondary tank.

.10 A drain shall be provided on the secondary tank.

.7 The unit shall be housed in an outdoor enclosure as follows:

.1 Weatherproof Sound attenuating enclosure (<70 dBA at 7 meters)

.2 Winter package rated for – 20 deg C operation

.3 Automatic Louvers to modulate enclosure heat.

.8 Communication

.1 The Generator shall be able to communicate via Ethernet/IP protocol.

1.3 MANUFACTURER

.1 Generator: Blue Star, Detroit Diesel/MTU, Cummins, Kohler Power Systems or approved equivalent.

1.4 SUPPLIER QUALIFICATIONS AND QUALITY ASSURANCE

.1 Qualifications: service and parts facilities in close proximity with 24 hour service, experienced in installation and operation of set of comparable size.

.2 A minimum of five years experience in the design, manufacture, assembly and testing of diesel fuel generator systems is required.

.3 All work shall meet requirements of Quality Standard CSA Z299.3.

1.5 SHOP DRAWINGS

.1 Submit within 2 weeks of contract award an electronic copy (PDF format) of shop drawings for review to Engineer.

.2 An electronic copy will be returned to the Contractor within 2 weeks of receipt as reviewed, reviewed as noted, or rejected. Contractor shall incorporate changes identified on the drawings and resubmit the drawings for further review within two weeks.

.3 Do not proceed with fabrication of equipment until review process is completed.

.4 Shop drawings and specifications shall include, but not be limited to, the following:

.1 Engine: make, model, rating and performance curves.

.2 Starter motor, make, model.

.3 Generator: make, model and rating complete with generator saturation curves, heat damage curves, reactive capability and special data.

.4 Voltage Regulator: make, model, type.

.5 Governor: type, model.

.6 Battery: make, type, voltage, capacity.

.7 Charger: make, model, input and output rating.

.8 Submit a general outline drawing of the complete assembly showing engine and generator mounting , exhaust, recirculating and intake air louvre arrangement, exhaust gas silencer and pipe arrangement, locations of fuel and lubricating oil filters, fuel supply and return line connections, lubricating oil drain valve, air cleaner, engine instrument panel, starting motor, power and control junction boxes, engine and generator mounting feet. Indicate on drawings horizontal and vertical dimensions, minimum door opening required for moving the unit, head room required for removal of piston and connecting rod, and weight of engine, generator, baseplate and exhaust silencer.

.9 Baseplate construction details and materials.

.10 Type and layout of all panels.

.11 Schematic and wiring diagrams of engine, generator and control panel.

.12 Single line diagram showing all breakers, switches, metering and protective relays.

.13 Field wiring diagrams.

.14 Complete bill of materials, including manufacturer's name, catalogue numbers and capacity.

.15 Type of Ethernet interface and protocol used.

.5 Device Numbering System shall be in accordance with IEEE 200-1975 Reference Designations for Electrical and Electronics Parts and Equipment.

.6 Responsibility for errors and omissions in the drawings submittal is not relieved by review of submittals by Owner or the Engineer

1.6 MAINTENANCE DATA AND INSTRUCTION MANUALS

.1 Provide, but not be limited to, the following in English for incorporation into instruction manuals:

.1 Complete set of reviewed shop drawings.

.2 Factory test data of engine, generator, exciter, control logic, metering and all other pertinent test data.

.3 Maintenance and operation bulletins for:

.1 Engine and Accessories.

.2 Generator.

.3 Voltage Regulator and Accessories.

.4 Exciter.

.5 Permanent magnet generator if installed.

.6 Battery Charger.

.7 Speed Governor.

.8 Starting Motor.

.9 Batteries.

.10 Ventilating Equipment.

.11 Timers, Relays, Meters.

.12 Power Circuit Breakers.

.13 Other Accessories.

.2 If brochures are submitted, these shall be originals; photocopies are not acceptable. Brochures shall contain all technically relevant data.

.3 Complete sequence of system operation.

.4 Complete bill of materials including nameplate data of equipment and accessories.

.5 Forward, two weeks prior to the factory tests, one copy of instruction manual.

.6 Forward, within two weeks after the factory tests, three copies of instruction manuals, with updated drawings.

1.7 GUARANTEE

.1 Provide a written guarantee signed and issued to the Owner stating that the complete assembly consisting of the natural gas generator unit and all equipment and accessories is guaranteed against defects and malfunction for a period of two years from the date of installation.

1.8 SPARES

.1 For panels provide the following:

.1 One spare control circuit breaker per rating.

.2 Six spare indicating light bulbs per rating.

.3 One spare control relay and socket per rating and contact arrangement.

.2 Provide for the generator unit, a standard set of engine manufacturer's spare parts for one year normal operation 1,000 operating hours. Spares to include as a minimum:

.1 Two fuel filter elements for each type of fuel filter/water separator.

.2 Two lubricating oil filter elements.

.3 Three air cleaner elements.

.3 Provide conclusive evidence that a Canadian distributor has been established and will stock in Canada spare parts likely to be required during the normal life of the engine.

1.9 ACCEPTANCE TESTS

.1 General: before acceptance, assemble and setup the unit, complete with specified equipment, for tests at the supplier's plant. Tests may be witnessed by the Engineer on a date mutually agreed on. Provide suitable test area with adjustable loading facilities. Supplier shall ensure that the engine has run in sufficiently prior to load test, all test forms filled in, system debugged and recorders connected.

.2 Examination of product: A complete mechanical and electrical examination to determine compliance with specification and drawings with respect to materials, workmanship, dimensions and marking.

.3 Non-operational tests and checks: perform following test and checks before starting the unit:

.1 Shaft alignment, end float, angular and parallel.

.2 Cold resistance of generator windings.

.3 Belt tensioning.

.4 Equipment grounds.

.5 Electrical wiring.

.6 Personnel safety guards.

.7 Air cleaner.

.8 Lubricating oil type and level.

.9 Type of fuel.

.10 Vibration isolator adjustment.

.11 Temperature and pressure sensors.

.12 Engine exhaust system.

.13 Tools.

.14 Spares.

.15 All lubricating points.

.4 Operation test and check: on completion of paragraph 1.10.3, start the unit cold. Provide multi-channel recorder and record the following:

.1 Time for unit to start and reach settled voltage and frequency.

.2 Time from initiation of start to full load application, with voltage and frequency settled.

.3 Voltage and frequency transient and steady state limits for full load to no load, ¾ load to no load, ½ load to no load and ¼ load to no load and vice versa.

.4 Record battery voltage drop during cranking.

.5 Protection and control demonstration: on completion of paragraph 1.10.4, demonstrate the following:

.1 Overheat protection.

.2 Low oil pressure protection.

.3 Cranking cut out.

.4 Overcrank protection (3 tries).

.5 Overspeed protection.

.6 Under and over frequency.

.7 Under and over voltage.

.8 All control functions.

.6 Factory Load Test:

.1 Perform torsional analysis test of engine and generator compatibility.

.2 Perform a four hour load test using a portable test bank. Perform test for three hours with load applied in 20% steps every 30 minutes until full load is applied and one hour at 110% full load. Record following at 30 minute intervals during the entire test:

.1 Kilowatts

.2 Amperes

.3 Voltage

.4 Frequency

.5 Oil Pressure

.6 Coolant Temperature

.3 Test response of governor (droop or isochronous) applying 20% load and 100% load in one step. Use a storage oscilloscope or strip chart recorder to determine response time, voltage and frequency fluctuations during test.

.4 Test voltage regulator and compare for conformance to manufacturer's product data.

.5 Record noise level measurements in dB at various locations around unit and area surrounding exhaust port.

.6 Submit certified tests results for approval by owner representative.

.7 Field Load Test:

.1 Perform a four hour load test using a portable test bank. Perform load test with load applied in 20% steps every 30 minutes until full load is applied. Record following at 30 minute intervals during the entire test:

.1 Kilowatts

.2 Amperes

.3 Voltage

.4 Frequency

.5 Oil Pressure

.6 Coolant Temperature

.2 Test all alarm and shutdown circuits by simulating conditions. Closing or opening of appropriate sensor contacts mechanically is not acceptable.

.3 Record noise level measurements in dB at various locations in generator room and area surrounding exhaust port.

.8 Interpretation of ambient room temperature: consider ambient room temperature as that temperature, which is the lowest temperature registered out of a group of three thermometers when placed in engine enclosure as follows:

.1 One thermometer located on each side of the engine block, approximately two-thirds of the length of the block back from front end of block, 900 mm out from block and at a height equal to height of block. A third thermometer located over end of exciter on the unit centreline, approximately 150mm above top of exciter.

.2 Take the thermometer showing the lowest temperature to give true ambient air temperature. Adjust temperature to maintain this thermometer at 40 degree C during the heat test.

.9 Voltage and frequency regulation tests: on completion of load tests take the hot reading of generator windings. Subject the unit to hot voltage and frequency regulation tests for full load to no load, 3/4 load to no load, 1/2 load to no load, 1/4 load to no load and vice versa.

.10 Panel performance and functions: check sequence of operation under service conditions. Make provision for supplying and connecting required levels of voltage for primary circuits. Test overcurrent relays by impressing current in secondary circuits.

.11 Hi-pot tests: perform over potential tests on primary and secondary wiring in accordance with appropriate EEMAC Standard.

.12 Additional tests: perform any tests, consistent with the contract, to satisfy the Owner of the adequacy and satisfactory operation of the unit.

.13 Supplier shall record all test data on manufacturer's test forms and be complete with diagrams and description of test results, deficiencies and corrective action. Test data sheets shall be signed by the supplier and Owner's representative.

1.10 REFERENCES

.1 Each assembly shall be constructed and tested in accordance with all applicable sections of the latest revision of the following codes.

.1 Canadian Standards Association (CSA).

.2 Electrical and Electronic Association Manufacturers of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 American National Standards Institute (ANSI).

.5 Institute of Electrical and Electronic Engineers (IEEE).

.6 American Society of Mechanical Engineers (ASME).

.7 American Society for Testing and Materials (ASTM).

.8 Society of Automotive Engineers (SAE).

.9 Canadian Government Specifications Board (CGSB).

.10 International Standards Organization (ISO).

.11 Provincial Electrical Protection Act.

2. PRODUCTS

2.1 ASSEMBLY

.1 Provide the following items plus such other items as necessary to make the unit complete as implied or intended:

.1 Natural Gas Engine.

.2 Natural Gas Engine Accessories.

.3 Baseplate and Drip Pan.

.4 Vibration isolators.

.5 Governor.

.6 Engine Exhaust System.

.7 Engine Cooling System.

.8 Engine Ventilating System.

.9 Starting Motor(s).

.10 Batteries and Rack.

.11 Battery Charger.

.12 Generator and Exciter.

.13 Voltage Regulator and Accessories.

2.2 GENERAL CONSTRUCTION

.1 Mount on common steel rail base complete with steel spring vibration isolators between rail base and concrete base pad.

.2 Provide semi-flexible couplings between generator and engine and protective guards over moving parts.

.3 Machine enamel finish to be approved by the Engineer.

.4 Provide fuel shut-off valve.

2.3 WIRING AND CONNECTIONS

.1 Provide all conduit, wiring and connections required and recommended by unit supplier.

.2 Install all control and alarm wiring in rigid steel conduit.

.3 Connect neutral point of generator and generator frame to ground by #1/0 copper conductor.

2.4 TOOLS

.1 Provide a complete set of specialized tools required for the proper care, adjustment and maintenance of equipment supplied.

2.5 SIGNS

.1 Provide and attach to the unit in a prominent location a warning sign indicating that generator starts automatically.

2.6 FINISHING AND PAINTING

.1 Properly clean, finish and paint equipment with a smooth and durable finish. Use grey gloss 501.108 except inside of panel to be painting with white gloss 513-101 in accordance with CGSB 1GP-12c schedule of paint colours.

2.7 WORKMANSHIP

.1 Manufacture and construct the equipment with new materials, and in the best workmanship manner.

.2 Give particular attention to freedom from blemishes, defects, burrs and sharp edges; accuracy of dimensions and marking of parts and assemblies; thoroughness of welding, brazing, painting and wiring, alignment of parts and tightness of assembly screws and bolts.

3. EXECUTION

3.1 COORDINATION WITH OTHER SECTIONS OF WORK

.1 Coordinate to ensure proper execution of work covering ventilation, field supply and products-of-combustion exhaust, to form an efficient and well-coordinated layout.

END OF SECTION

1. GENERAL

1.1 REGULATORY REQUIREMENTS

.1 Manufacture unit to CEMA standards.

2. PRODUCTS

2.1 COMPONENTS

.1 Provide generator, drip proof, single bearing and close coupled to engine with SAE housing. Generator to have a full amortisseur winding, direct connected brushless exciter with easily removable bolt-on diodes with surge protection, and meet or exceed EEMAC MGI-22 and current IEEE standards.

.2 Maximum deviation of open circuit terminal voltage waveform not to exceed 5%.

.3 Provide permanent magnet generator (PMG) for generator short circuit sustaining capability not less than 2.4 times rated current.

.4 Generator winding insulation shall be Class F; winding temperature rise not to exceed 80 degree C as measured by resistance in an ambient temperature of 40 degree C.

.5 Identify generator windings with metal tags. Bring windings to insulated terminals in a metal junction box mounted on the side or top of generator. Size junction box to permit mounting of engine and generator low voltage controls and wiring terminals blocks. Provide barrier in junction box to separate low and high voltage wiring.

.6 Provide a voltage regulation system complete with auto/manual control module. Voltage regulator shall be capable of withstanding continuous vibration, 15G shock and temperature up to 50 degrees C while maintaining accuracy to plus/minus 1%.

.7 Steady-state voltage regulation not to exceed 1%. Transient voltage regulation, when full load is applied or removed, not to exceed 10% when measured by oscilloscope or high speed strip chart recorder with recovery time to steady-state less than 3 seconds.

.8 Design equipment to minimize radio frequency interference (RFI) under all operating conditions. Balanced telephone influence factor (TIF) to meet or better requirements of EEMAC Standard MGI-22.43.

.9 A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability. This breaker shall not trip within the 10 seconds to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset, preventing restoration of voltage if maintenance is being performed.

3. EXECUTION

3.1 INSTALLATION

.1 Provide terminal box for generator and exciter leads.

.2 Install unit complete and make operational.

3.2 MOUNTING

.1 Connect engine flywheel housing rigidly to generator stator housing with SAE adapter. Mount unit on a common, heavy duty, fabricated steel baseplate. Design and materials of baseplate must be approved by engine manufacturer.

.2 Baseplate of sufficient rigidity to maintain alignment of engine-generator shafts and frames under all conditions incident to shipping, installation and service.

.3 Machine engine-generator feet and baseplate sole plates parallel and true. Shimming to be steel type and only permitted underneath the generator feet.

.4 Support baseplate on spring type isolating fixtures from welded side brackets located in such a manner that bottom of baseplate will be approximately 25mm above supporting floor. Isolators shall have cast iron housings and be complete with leveling bolts, adjustable oil proof snubbers and minimum 6mm sound pads. Isolation efficiency to be not less than 95%.

.5 Determine quantity and location of isolators in such a manner that each isolator will carry equal proportion of weight and that the pressure exerted on the floor by each isolator does not exceed 345 kPa.

.6 Isolators shall be shipped loose for installation at project site.

.7 Unit to be suitable for mounting directly on a concrete floor slab base with suitably sized Hilti anchors.

END OF SECTION

1. GENERAL

.1 Not Applicable

2. PRODUCTS

2.1 DESIGN/COMPONENTS

.1 Diesel fuel, heavy duty, cold start, liquid cooled, vertical in line or vee, and current manufacture of a type and size that has been service as a prime mover for electric power generation for not less than two years. Turbocharged engine acceptable providing brake mean effective pressure (BMEP) at rated output does not exceed 1800 kPa. Mechanically driven superchargers not acceptable.

.2 Capacity: Section – Engine Generators Basic.

.3 Circulation heater located in cooling jacket complete with immersion thermostat for 208 VAC operation.

.4 Accessories: Provide all replaceable type oil filters, dry type air cleaners, automatic, lubricating oils and greases, etc.

.5 Engine shall have a minimum of four (4) cylinders.

.6 Engine with auxiliary starting aids (e.g., glow plug assist start) not acceptable.

.7 Equip engine air intakes with dry type heavy duty air cleaners located close to the inlet manifold. Cleaner element to be directly replaceable with elements of Canadian manufacture.

.8 Provide engine wiring for auto-marine type with plastic shield. Use stranded, minimum No. 14 AWG, TEW 105 ^{o}C and coloured coded wires. Terminal wiring with coded, insulating terminals flanged fork. Terminal blocks heavy duty, screw type. Wire markers of slip on oil proof type. Maximum of two wires per terminal block.

.9 Provide high quality gauges and instruments as specified in Section – Alarms and Instrumentation and provide other standard gauges and instruments. Calibrate and scale gauges and instrument in both metric and imperial units and symbols. Oil temperature sensors to be mounted on engine full flow pressure line. Hoses or tubing for gauges shall be high pressure reinforced type.

.10 Provide engine control panel complete with:

.1 Tachometer.

.2 Lubricating oil pressure gauge.

.3 Lubricating oil temperature gauge.

.4 Low Coolant level gauge.

.5 Engine switch auto-off-crank-start selector switch and crank pushbutton.

.6 Terminal blocks for connection to D.C. power supply, engine monitoring and shutdown device.

.7 Low pressure, high coolant temperature, and overspeed protection to shut down engine on automatic and manual operation.

.11 Mount unit accessories, including gauges, instruments, and protective sensors, in such a manner that machine vibrations are isolated or dampened.

.12 Dynamically balance complete engine-flywheel generator arrangement after assembly. Guarantee no torsional or other harmful vibration within 10% above or below rated speed of unit, when operating unloaded or connected to any load within its rating. Cyclic irregularity to be no greater than 1/250.

.13 Provide engine flywheel with graduated marking around its periphery to facilitate fuel injunction and valve timing.

.14 Provide personnel safety guards for exposed moving parts and exhaust manifolds. Provide platform for servicing upper part of engine where applicable.

2.2 SPEED GOVERNOR

.1 Provide full electronic governor with speed changer and dry type actuator. Governing System shall be in accordance with ISO 3046/4-1978(E).

.2 Governor shall provide the following features:

.1 Ten turn locking type manual speed adjustment.

.2 Speed regulation, steady state, no-load to full load and vice versa: +/-0.25%, three cycles maximum with two second maximum recovery to steady state.

.3 Transient peak, no-load to full-load and vice versa: +/-0.10%.

.4 Recovery time to steady state condition on application of full load from no load not to exceed three seconds.

.5 Frequency shall be externally adjustable from zero to 5% while engine is running.

.6 Class A accuracy.

2.3 LUBRICATION SYSTEM

.1 Provide a full pressure lubricating system complete with filter and oil cooler.

.2 Oil pump shall be engine driven gear type complete with strainer.

.3 Equip engine oil sump with oil drain pipe, gate valve and pipe cap. Permit complete drainage in a convenient manner.

.4 All metallic oil hoses shall be of the steel reinforced rubber type with crimped or swaged end fittings.

.5 Provide the initial fill of all required fluids and lubricants for the generator.

.6 Engine crankcase breather to be equipped with device to minimize emission of oil vapors.

3. EXECUTION

3.1 INSTALLATION

.1 Install unit complete and make operational.

END OF SECTION

1. GENERAL

.1 Not Applicable

2. PRODUCTS

2.1 COMPONENTS

.1 Engine to include self-contained liquid cooling complete with fan maintaining safe operating temperature for unit under full load conditions.

.2 Enclosure to be equipped with motorized dampers.

END OF SECTION

1. GENERAL

.1 Not Applicable.

2. PRODUCTS

2.1 COMPONENTS

.1 Muffler and piping: hospital type, completely sealed, metal, primed finish.

3. EXECUTION

3.1 INSTALLATION

.1 Coordinate size and installation of exhaust piping with mechanical section and generator set supplier.

.2 Install muffler horizontally on spring type compensating hangers as close to unit as practical.

.3 Provide 12 mm copper drain line from bottom of muffler to drain cock for periodic draining of muffler.

.4 Provide flexible connection from manifold to muffler.

END OF SECTION

1. GENERAL

1.1 SYSTEM

.1 Unit to be for automatic starting upon power failure.

2. PRODUCTS

2.1 COMPONENTS

.1 Provide a complete starting system including cranking starting motor, batteries, battery stand, heavy-duty battery cables and wall mounted battery charger.

.2 Provide positive engaging type cranking motor. Cranking motor and flywheel ring gear arrangements which may permit tooth to tooth abutment not acceptable.

.3 Provide lead acid battery with sufficient capacity to crank the unit at engine manufacturer's recommended cranking starting speed for a period of 3 minutes. Voltage measured at starting motor terminals at end of 3 minutes cranking, with cranking current flowing, to be not less than 1.75 V per cell. Size battery on the basis of engine and battery manufacturer's published data. Battery termination shall be bolt-on or study type. Terminals and all exposed electrical connections shall be protected from accidental short circuit by falling conductive objects on the battery. Such protection shall be transparent.

.4 Provide battery stand coated with acid resistant paint and fabricated from angle irons with 20 mm plywood bottom.

.5 Provide battery charger with 120 volt AC input and output equal to 1.20 of the ampere-hour capacity of the battery based on an 8 h rate. Output voltage ripple shall be 3% or less. Provide an AC input circuit breaker and a 24 h terminating equalizer timer with approximately 4 m of connecting cord and permanent connectors for connecting to battery terminals. Provide 5 spare fuses inside charger panel. Charger to be CSA approved.

.6 Provide necessary heavy duty, maintenance-free battery cables and connectors. Select cable wire size on the basis of allowing not more than 5% voltage drop at time of peak load. Cable length to be sufficient to allow battery to be located on either side of the engine.

3. EXECUTION

3.1 OPERATION

.1 Stop/Start Sequence: See Section – Alarms and Instrumentation.

.2 Battery Charger: adjustable rate of charge, "floating" on batteries at all times with full charging period of 24 hours maximum.

END OF SECTION

1. GENERAL

1.1 SYSTEM

.1 Provide a digital solid state controller complete with all control and power modules for sensing, timing, logic and instrumentation to control the diesel generator set and automatic transfer system in accordance with Section 46 of the Canadian Electrical Code and the electrical inspection authority.

2. PRODUCTS

2.1 CONTROLLER

.1 The controller shall include, but not be limited to, the following features:

.1 Set-mounted controller capable of facing right, left or rear shall be vibration isolated on the generator enclosure. The controller shall be capable of being remote mounted. The microprocessor control board shall be moisture proof and capable of operation from -40ºC to 85ºC.

.2 Fused DC circuit.

.3 Complete 2-wire start/stop control, which shall operate on closure of a remote contact.

.4 Speed sensing and independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel.

.5 The starting system shall be designed for restarting in the event of a false engine start by permitting the engine to completely stop and then re-engage the starter.

.6 Cranking cycler with 15 second ON and OFF cranking periods.

.7 Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.

.8 Circuitry to shut down the engine if high coolant temperature, low oil pressure or overspeed. Shutdown to occur in either automatic or test modes.

.9 Engine cooldown timer set at 5 minutes to permit unloaded running of the generator after transfer of the load to normal.

.10 3-position (Auto-Off-Test) selector switch. In the Test position, the engine shall start and run regardless of the position of the remote starting contacts. In the Auto position, the engine shall start when contacts in the remote control circuit close and stop 5 minutes after those contacts open. In the Off position, the engine shall not start even if the remote start contacts close. The Off position

shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the Off position.

.11 Ethernet/IP connection for remote monitoring of equipment. Monitoring software, if required, is to be provided with unit.

.12 Controller enclosure heater where the genset is located outdoors in non-heated enclosure.

2.2 INSTRUMENT PANEL

.1 The instrument panel shall include, but not be limited to, the following features:

.1 Standard indication by means of indicating lights (colours shown) or display screen as follows:

.1 Not-in-Auto (flashing red).

.2 System Ready (green).

.3 Overcrank (red).

.4 Emergency Stop (red).

.5 Prealarm High Engine Temperature (yellow).

.6 High Engine Temperature (red).

.7 Prealarm Low Oil Pressure (yellow).

.8 Low Oil Pressure (red).

.9 Overcrank (red).

.10 Battery Charger Malfunction (red).

.11 Low Battery Voltage (red).

.12 Low Fuel (red).

.13 Fuel Tank Leak (red).

.2 Test button required for indicating lights where indicating lights used.

.3 Voltage indication per phase via gauge or display screen, +/- 2% accuracy.

.4 Current indication per phase via gauge or display screen, +/- 2% accuracy.

.5 Frequency indication via meter or display screen, +/- 0.5% accuracy, scale 45 Hz to 65 Hz.

.6 Battery charging voltage indication via gauge or display screen.

.7 Coolant temperature indication via gauge or display screen.

.8 Oil pressure indication via gauge or display screen.

.9 Running-time meter via gauge or display screen.

.10 Voltage-adjustment via control panel or rheostat.

2.3 FUEL LEVEL INDICATION

.1 Provide local (to generator) fuel level indication (0% to 100%).

.2 Provide remote fuel level indication (0% to 100%). This is to be a 4-20mADC signal used for station Control System.

2.4 REMOTE CONTROL AND ALARM/STATUS INDICATION

.1 Provide dry contacts for each of the following alarm/status indications:

.1 Run Status.

.2 Not-in-Auto.

.3 Common Prealarm.

.4 Common Fault.

.5 Low Fuel.

.6 Fuel Tank Leak.

.2 Run Relay to provide a three-pole, double-throw relay with 10 amps at 250 VAC contacts for indicating that the generator is running.

.3 Provide data communication interface using Ethernet/IP protocol.

END OF SECTION

1. GENERAL

1.1 INTENT

.1 Supply and install submersible turbine pump(s) as indicated on the Contract Drawings and in this Specification.

.2 Approved Manufacturers:

.1 Grundfos

.2 Approved Alternates:

.1 As approved by Engineer.

.2 Equipment supplied by approved alternate must be of the same or greater quality than equipment from specified manufacturer.

.3 All alternate pumps must conform to the intent of the approved manufacturer including technical specification, type, performance, flanges, materials of construction, motors, seals, etc.

.4 The Contractor is responsible for any piping, valving, and fitting modifications that may occur from using approved alternate pump selection.

.5 The Contractor is responsible for any electrical modifications including VFDs, generator sizing, wiring, etc. that may occur from using alternate pump selection.

.6 The Contractor is responsible for any additional engineering fees incurred by MPE Engineering Ltd., necessitated as a result of the supply of an alternative pump.

.3 All pumps to be provided by one manufacturer.

1.2 RELATED SECTIONS

.1 Section 01 33 01 – Project Record Documents

.2 Section 40 95 73 – Instrument Wiring

.3 Section 40 00 00 – Mechanical General Requirements

.4 Section 40 80 01 – Disinfection, Hydrostatic and Pressure Testing

1.3 REFERENCE STANDARDS

.1 ANSI Standards:

.1 B-16.5 Pipe Flanges and Flanged Fittings

.2 ANSI/HI 9.6.4-2009 American National Standard for Rotodynamic Pumps for Vibration Measurements and Allowable Values

.2 OH&S Standards:

.1 Applicable Standards.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with General Conditions.

.2 Shop drawings and product data to include the following:

.1 Performance curves, which include differential head, efficiency, water NPSHR, and brake horsepower.

.2 Outline and arrangement drawings.

.3 Cross-section drawings.

.4 Materials of construction.

.5 Details of seal arrangement.

1.5 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into the manual specified in Section 01 33 01 – Project Record Documents.

.2 Maintenance data to include the following:

.1 Manufacturer’s name, type, model year, capacity and serial number.

.2 Details of operation, servicing, and maintenance.

.3 Recommended spare parts list with names and addresses.

.4 As-built wiring diagrams.

.5 Performance curves.

1.6 DESIGN CRITERIA

.1 Unless stated herein or waived in writing by the Engineer, submersible turbine pump construction, materials, methods and performance shall conform to AWWA Standard E101-88, latest revision.

.2 Setting

.1 The Contractor shall be responsible for ascertaining and confirming the exact pump setting length.

.2 The dimension from the underside of the pump to the bottom of the sump shall conform to the manufacturer's recommendations and this dimension shall be clearly indicated on the pump shop drawings.

1.7 TAGGING

.1 Provide each piece of equipment with a tag stamped or engraved with the appropriate equipment number, as listed in this Specification.

.2 Tags to be 20 mm high, 75 mm long, and 1.5 mm thick Lamecoid with 10 mm high alphanumeric characters, Helvetica font, reverse engraved. Characters to be white on coloured background. Background colour to be red.

.3 The code lettering and number system shall be as shown on the P & I drawings or as directed by the Engineer.

.4 Affix tags to equipment securely.

1.8 QUALITY ASSURANCE

.1 Ensure that installations conform with all applicable local. Provincial, and/or Federal codes, standards, and regulations in effect at time of bid.

.2 Comply with the requirements of the following organizations, at minimum:

.1 CSA, Canadian Standards Association.

.2 NEC, National Electric Code.

.3 NEMA, Standards of National Electrical Manufacturers Association.

.4 ANSI, American National Standards Institute.

.5 ASTM, American Society for Testing and Materials.

.6 AISI, American Iron and Steel Institute.

.7 AGMA, American Gear Manufacturer's Association.

.8 AISC, American Institute of Steel Construction.

.9 AWS, American Welding Society.

.10 ASME, American Society of Mechanical Engineers.

.11 NSF, National Sanitation Foundation.

1.9 MATERIALS

.1 All 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 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

2. PRODUCTS

2.1 SUBMERSIBLE WELL PUMP - P 102

.1 Location: Production Well

.2 Conditions:

- .1 Liquid: Potable Water
- .2 Temperature: 20°C (68°F)
- .3 Flow PHD: 3. L/sec (48 USgpm)
- .4 TDH field: 35 m (115 ft)
- .5 Well Depth: 10.23m. **(To be field confirmed by Contractor.)**
- .6 Pump to operates on variable frequency drive:
  - .1 Range of Pump Operating Speeds:
    - .1 Minimum = 1800 rpm (30 Hz)
    - .2 Maximum = 3450 rpm (60 Hz)

.3 Specified Equipment:

- .1 Manufacturer: Grundfos Submersible Turbine Pumps or approved equivalent
- .2 Supplier: Chamco
- .3 Model: 45S20-5
- .4 Stages: 5
- .5 Discharge Size: 50 mm (2”) NPT
- .6 Pump Components:
  - .1 Discharge Bowl: ASTM 304 SS
  - .2 Intermediate Bowl: ASTM 304 SS
  - .3 Impeller: ASTM 304 SS
  - .4 Strainer: ASTM 304 SS
  - .5 Shaft: ASTM 416 SS
  - .6 Coupling: ASTM 416 SS
- .7 Motor and Electrical Data:
  - .1 Model: Grundfos MS 402
  - .2 Motor Diameter: 100 mm (4”)
  - .3 Motor: 2 HP; 575 VAC; 3 phase, 60 Hz; 3450 rpm; 1.25 S.F. Suitable for Varying Frequency Drives.
- .8 Accessories:
  - .1 Integral Check Valve

2.2 ACCESSORIES

.1 Provide all anchor bolts, shims and miscellaneous accessories necessary for installation of the pumping equipment and drivers.

.2 Provide the following spare parts, to be delivered to the site and handed over to the Owner at the time of commissioning:

.1 Sufficient lubricating oils and greases of correct grade and specification for 12 months operation of all equipment requiring such.

.2 Any other spares which may be required to comply with the manufacturer's operating and maintenance instructions and recommendations during the course of the first 12 months of operation.

3. EXECUTION

3.1 MARKING, PACKING AND PACKAGING

.1 Equipment shall be marked to identify the product, date (month and year) of manufacture, capacity, and serial number. Equipment shall be shipped with a label containing equipment description, manufacturing order number, part number, serial number, manufacturer, and date.

.2 The proper caution or warning signs as prescribed by OH&S standard shall be customer determined and supplied.

.3 All packing, packaging, and marking provisions of ASTM Practice D3892 shall apply to this standard.

3.2 SHIPPING, RECEIVING AND STORAGE

.1 Various sections of the equipment to be properly match-marked to assist in positioning and assembly at the site.

.2 The pumps shall be shipped to site assembled to the greatest extent possible to reduce installation and start-up costs.

.3 Provide instructions on storage and protection well in advance of shipping. If any special instructions are necessary covering safe storage, give them to the Contractor.

.4 The Contractor will sign the carrier's bill of lading to indicate receipt of the required number of crates, packages, etc., and will note thereon any apparent shortages of or visible damage to such crates, packages, etc. The supplier shall furnish to the Contractor, lists showing the contents of the said crates, packages, etc., complete with all necessary handling and off-loading instructions. Such lists shall be furnished sufficiently early so that copies will be available at the site when delivery of the said equipment and appurtenances is made. Within seven days after the date of delivery to the site, the Contractor will notify the Supplier in writing of shortages or damage in equipment delivered.

.5 The Contractor will provide unloading facilities and place the equipment in location or storage. The Contractor will be responsible for off-loading at site, for storing the equipment, appurtenances and materials and for protection against weather loss, damage, or theft. The supplier shall provide full instructions of all precautions to be observed in connection with the handling, storing and protection of the equipment.

3.3 INSTALLATION

.1 Install all pumping equipment in strict accordance with manufacturer's and supplier's instructions.

.2 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.

.3 Make equipment installation and connections by skilled tradesmen to the best standard.

.4 Carry out work to produce a neat, accurate, secure, functional installation.

.5 Repair at own expense, any damage done to the installation of materials while carrying out the work.

.6 Install flow sleeve in advance of equipment installation in accordance with manufacturer's instructions.

.7 Upon completion of installation, fill, add to, and check equipment requiring lubricating oils, greases and coolants. Types and amounts to be in strict accordance with manufacturer's recommendations.

3.4 EQUIPMENT TESTING PROCEDURE

.1 Submit a thorough description of the procedures to be employed in testing this equipment. The procedure will be reviewed by the Engineer for suitability and should be submitted 3 weeks prior to any testing.

3.5 FIELD TESTING

.1 When equipment installation has been completed to the standards indicated by these specifications, arrange for the services of the equipment manufacturer's technical representative.

.2 The equipment manufacturer's technical representative shall inspect the installation to ensure that the equipment has been installed in accordance with the manufacturer's requirements. If the installation is not in order, correct the deficiencies indicated by the technical representative. Start, run and adjust equipment at this time. The technical representative shall then advise the Engineer in writing that the installation has been checked, has been installed correctly and is in working order.

.3 Bear all the costs of the equipment manufacturer's technical representative.

.4 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 the construction prior to final inspection.

3.6 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

.1 The equipment manufacturer's technical representative shall be familiar with the equipment supplied and shall come prepared with both knowledge and equipment to perform and interpret the test, inspections and procedures recommended by the manufacturer for the starting of equipment that has not previously been run.

.2 The equipment manufacturer's technical representative shall, immediately after completion of the inspection, convey to the Engineer in writing, confirmation of the tests and inspections carried out and the result of this examination of the work.

.3 If the inspection reveals defects in the work, correct as soon as possible and repeat the entire inspection procedure. Repeat until the work passes the inspection.

.4 Document the results of the inspection by the equipment manufacturer's representative.

.5 Ensure the installation meets all manufacturer's requirements for durable and trouble-free operation.

3.7 FIELD INSPECTION

.1 Final inspection will be made by the Engineer only after the equipment manufacturer's technical representative has advised that equipment installation is in order and the Contractor has advised in writing that the system can be 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. 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 re-inspected, the cost of the inspection will be borne by the Contractor.

3.8 OPERATOR TRAINING

.1 Supplier shall provide the services of a skilled technical representative for a minimum period of two (2) hours at the site to instruct plant personnel in the operation and service of the equipment.

END OF SECTION

1. GENERAL

1.1 INTENT

.1 This section of the specifications refers to the piping, fittings, valves and all piping specialties and supporting devices to be installed under this contract. Also included are the equipment, valve and commodity identification legends for all piping systems to be installed.

.2 Control valves and other in-line equipment, such as flow meters, pumps, flow control valves, flow switches, pressure switches, solenoid valves, pressure gauges, etc., are to be installed under this Section.

1.2 RELATED SECTIONS

.1 Section 01 33 01 – Project Record Documents

.2 Section 40 95 73 – Instrument Wiring

.3 Section 40 91 00 – Process Measurement Devices

.4 Section 40 05 40 – Detailed Piping Specifications

.5 Section 40 05 90 – Valves

.6 Section 40 80 01 – Disinfection, Hydrostatic and Pressure Testing

1.3 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 Steel 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 ANSIB16.15, 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 ASME B31.1, Power Piping
- .14 ASME B31.3, Process Piping
- .15 ASME 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 A74, Cast Iron Soil Pipe and Fittings
.23 ASTM A105/A105M, Forgings, Carbon Steel, for Piping Components
.24 ASTM A106, Seamless Carbon Steel Pipe for High Temperature Service
.25 ASTM A126, Grey-Iron Castings for Valves, Flanges, and Pipe Fittings
.26 ASTM A135, Electric-Resistance-Welded Steel Pipe
.27 ASTM A139, Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over)
.28 ASTM A167, Stainless Steel and Heat-Resisting Chromium- Nickel Steel Plate
.29 ASTM A181/181M, Forgings, Carbon Steel, for General Purpose Piping
.30 ASTM A182/182M, Forged or Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
.31 ASTM A193/193M, Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
.32 ASTM A194/194M, Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
.33 ASTM A197, Cupola Malleable Iron
.34 ASTM A234/A234M, Pipe Fittings of Wrought Carbon Steel and Alloy steel for Moderate and Elevated Temperatures
.35 ASTM A240, Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
.36 ASTM A269, Seamless and Welded Austenitic Stainless Steel Tubing for General Service
.37 ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes
.38 ASTM A307, Carbon steel Bolts and Studs, 60,000 psi Tensile Strength
.39 ASTM A312/312M, Seamless and Welded Austenitic Stainless Steel Pipe
.40 ASTM A320/320M, Alloy Steel Bolting Materials for Low-Temperature Service
.41 ASTM A403/A403M, Wrought Austenitic Stainless Steel Piping Fittings
.42 ASTM A409/A409M, Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service
.43 ATSM A480/A480M, General Requirements for Flat-Rolled Stainless for Heat-Resisting Steel Plate, Sheet and Strip
.44 ASTM A536, Ductile Iron Castings
.45 ASTM A563, Carbon and Alloy Steel Nuts
.46 ASTM A570/A570M, Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality
.47 ASTM A774/A744M, As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
.48 ASTM A778, Welded, Unannealed Austenitic Stainless Steel Tubular Products
.49 ASTM B88, Seamless Copper Water Tube
.50 ASTM C76, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
.51 ASTM C564, Rubber Gaskets for Cast Iron Soil Pipe and Fittings
.52 ASTM D638, Test Method for Tensile Properties of Plastics
.53 ASTM D792, Test Method for Specific Gravity and Density of Plastics by Displacement
.54 ASTM D1248, Polyethylene Plastics Moulding and Extrusion Materials
.55 ASTM D1457, PTFE Moulding and Extrusion Materials
.56 ASTM D1784, Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

.57 ASTM D1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
.58 ASTM D2241, Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
.59 ASTM D2466, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
.60 ASTM D2467, Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
.61 ASTM D2513, Thermoplastic Gas Pressure Pipe, Tubing and Fittings
.62 ASTM D2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
.63 ASTM D2665, Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
.64 ASTM D2996, Filament-Wound Reinforced Thermosetting Resin Pipe
.65 ASTM D3212, Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals
.66 ASTM D3261, Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Fittings
.67 AST D4101, Propylene Plastic Injection and Extrusion Materials
.68 ASTM D4174, Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems
.69 ASTM F441, Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
.70 ASTM F894, Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
.71 AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
.72 AWWA C110, Ductile-Iron and Grey-Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids
.73 AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Grey-Iron Pipe and Fittings
.74 AWWA C115, Flanged Ductile-Iron and Grey-Iron Pipe with Threaded Flanges
.75 AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Moulds or Sand-Lined Moulds, for Water and Other Liquids
.76 AWWA C200, Steel Water Pipe, 6 Inches and Larger
.77 AWWA C203, Coal Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied
.78 AWWA C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 Inches through 144 Inches
.79 AWWA C206, Field Welding of Steel Water Pipe
.80 AWWA C207, Steel Pipe Flanges for Waterworks Services – Sizes 4 Inch Through 144 Inch
.81 AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings
.82 AWWA C209, Cold-Applied Tape Coating for Special Sections, Connections, and Fittings for Steel Water Pipelines
.83 AWWA C210, Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe
.84 AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines
.85 AWWA C301, Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids
.86 AWWA C303, Reinforced Concrete Pressure Pipe – Steel Cylinder Type, Pretensioned, for Water and Other Liquids
.87 AWWA C600, Installation of Ductile-Iron Water Mains and their Appurtenances
.88 AWWA C606, Grooved and Shouldered Joints

.89 AWWA C651, Disinfecting Water Mains
.90 AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water
.91 AWWA M11; Steel Pipe – A Guide for Design and Installation
.92 CGA, Canadian Gas Association Standards
.93 CAN/CGA B105 – Installation Code for Digester Gas Systems
.94 CISPI 301, Specification Data for Hubless Cast Iron Sanitary System with No-Hub Pipe and Fittings
.95 CPC, Canadian Plumbing Code
.96 CSA B52, Mechanical Refrigeration Code
.97 CSA B64 Series CSA Standards on Vacuum Breakers and Backflow
.98 CAN3-B70, Cast Iron Soil Pipe, Fittings, and Means of Joining
.99 CSA B137.3, Rigid PVC Pipe for Pressure Applications
.100 CSA B139, Installation Code for Oil Burning Equipment
.101 CSA B140.0 General Requirements for Oil Burning Equipment
.102 CSA B158.1 Cast Brass Solder Joint Drainage, Waste and Vent Fittings
.103 CAN3-B181.2 PVC Drain, Waste and Vent Pipe and Pipe Fittings
.104 CSA CAN3-Z299.3, Quality Verification Program Requirements
.105 CSA CAN-Z183, Oil Pipeline Systems
.106 CSA Z184 Gas Pipeline Systems
.107 CSA B242 Groove and Shoulder Type Mechanical Pipe Couplings
.108 EJMA STDS, Standards of Expansion Joint Manufacturers' Association, Edition No. 6
.109 Fluid Sealing Association Technical Handbook, Rubber Expansion Joint Division
.110 FEDSPEC, L-C530B(1), Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy
.111 MIL-H-13528B, Hydrochloric Acid, Inhibited, Rust Removing
.112 MIL-S-8660C, Silicone Compound
.113 MIL-STD-810C, Environmental Test Methods
.114 MSS SP25, Standard Marking System for Valves, Fittings, Flanges and Unions
.115 MSS SP43, Wrought Stainless Steel Butt Welding Fittings
.116 SAE J1227, Assessing Cleanliness of Hydraulic Fluid Power Components and Systems
.117 SSPC-P3, Canadian Government Standards Board
.118 SSPPC-SP6, Canadian Government Standards Board
.119 SSPC-SP10, Canadian Government Standards Board
.120 Plumbing and Drainage Regulations of Province of Saskatchewan
.121 Gas Protection Regulations of the Province of Saskatchewan
.122 Pressure Vessel Act of the Province of Saskatchewan
.123 The American Society of Mechanical Engineers. (ASME)
  .1 ASME Boiler and Pressure Vessel Code, Part I – Power Boilers
  .2 ASME Boiler and Pressure Vessel Code, Part IV – Heating Boilers
  .3 ASME Boiler and Pressure Vessel Code, Part VIII – Pressure Vessels
  .4 ASME Boiler and Pressure Vessel Code, Part IX – Welding and Brazing Qualifications
.124 The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
.125 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
.126 Department of Environment of the Province of Saskatchewan
.127 Air-Conditioning and Refrigeration Institute (ARI)

.128 National Fire Protection Association (NFPA)
.129 Air Movement and Control Association (AMCA)
.130 Canadian Gas Association
  .1 CAN/CGA B149.1 Natural Gas Installation Code
  .2 CAN/CGA-B149.2 Propane Installation Code
.131 National Building Code
.132 National Sanitation Foundation (NSF)
.133 American Petroleum Institute (API)
.134 CSA B214-07 Installation code for hydronic heating systems

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data.

.2 Shop drawings and product data to include the following:

  .1 Performance curves, which include differential head, efficiency, water NPSHR, and brake horsepower (where applicable).
  .2 Outline and arrangement drawings.
  .3 Cross-section drawings.
  .4 Materials of construction.

1.5 UNIFORMITY OF EQUIPMENT

.1 All valves, gauges and other equipment to be supplied by one manufacturer throughout to the extent practical. Variations will be permitted only where the major supplier cannot supply a particular piece of equipment as specified.

1.6 DRAWINGS AND DESIGN

.1 The drawings are intended to show the major details of the mechanical work but it is the Contractor's responsibility to examine the electrical, mechanical, structural and architectural drawings before beginning the work and report to the Owner's Representative any discrepancies or interferences which may occur.

1.7 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into the manual specified in Section 01 33 01 – Project Record Documents.

.2 Include the reviewed tag lists.

1.8 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 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

1.9 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 shall be 12 mm nominal diameter.

1.10 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 metre of any connection to equipment, on both sides of structural penetrations, within 0.6 metres of all threaded end valves, and at the spacing specified in the detailed piping specification sheets.

.2 For carbon steel piping less than 75 mm in diameter, butt-weld or use threaded couplings. Use unions where disassembly is required.

.3 For steel piping equal to or greater than 75 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 75 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 75 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.

1.11 TAGGING

.1 Provide each piece of equipment with a tag stamped or engraved with the appropriate equipment number, as listed in this Specification.

.2 Tags to be 20 mm high, 75 mm long, and 1.5 mm thick Lamecoid with 10 mm high alphanumeric characters, Helvetica font, reverse engraved. Characters to be white on coloured background. Background colour to be red.

.3 The code lettering and number system shall be as shown on the P & I drawings or as directed by the Engineer.

.4 Affix tags to equipment securely.

2. PRODUCTS

2.1 PIPE, FITTINGS AND VALVES

.1 All, fittings and standard valves to be in accordance with the line code sheet accompanying this section. All piping materials to be in accordance with the line code sheet accompanying section 40 05 40.

2.2 FLANGES

.1 Unless otherwise noted, make flanges on 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 Make flanges on stainless steel piping stainless steel slip-on, rolled-angle Van-Stone type, with a stainless steel back-up ring drilled to ANSI B 16.1, Class 125. Make the angle ring thickness equal or greater than the pipe or fitting to which it is welded. For digester gas services, make the flanges Lap-joint type with galvanized steel Lap-joint flange and in accordance with CGA B105. For instrument air services, make the flanges Lap-joint type with a stainless steel Lap-joint flange.

.3 Provide Class 125 flanges on cast or ductile pipe, conforming to ANSI B 16. 1.

.4 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.

.5 Do not use slip-on flanges that are attached to a pipe by means of set screws and gaskets.

2.3 LINK SEALS

.1 Seal pipes passing through concrete walls as indicated on drawings, in a watertight manner, with link type expanding rubber seals as manufactured by the Thunderline Corporation.
.2 Link seals shall have EPDM seal element, composite pressure plates, and steel bolts with zinc chromate treatment.

.3 Size to suit cored hole or sleeved hole as required.

.4 Support pipe on either side of seal so that seal is not load bearing.

2.4 DIELECTRIC COUPLINGS

.1 Wherever pipes of dissimilar metals are joined use dielectric couplings.

.2 Use insulating unions for pipe sizes 50 mm and smaller and insulating flanges for pipe sizes larger than 50 mm.

2.5 UNIONS

.1 Provide unions at all locations for all pipe materials so that the Operator can easily perform required maintenance of all equipment.

2.6 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.

2.7 THREADED COUPLINGS

.1 Make screwed joints using American Standard threads to ANSI B1.20.1.

.2 Use paste as thread lubricant for threaded joints, Loctite or approved equal.

.3 Conform to ASTM Al82 or ASTM A276, Class 150, for threaded connections to stainless steel pipe, threadolets 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.

2.8 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.

2.9 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.

.2 Steel Pipe: 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. Use rigid style couplings in all other applications.

.3 Where grooved joint piping systems connect to equipment or to flanged valves, meters, or other sensing devices; use grooved joint flanges or flange adapters. Acceptable products are: Tyler Groove to Flange Fittings or Victaulic Flange adaptors. 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.

.4 All couplings to be internally and externally epoxy coated.

2.10 FLEXIBLE COUPLINGS

.1 Flexible Couplings for non-buried to be Brico D-0-L
- .1 Stainless steel construction with stainless steel bolts, nuts and washers.
- .2 Gaskets: fabricated of material suitable to the service conditions.

2.11 FITTINGS

.1 For steel pipelines 75 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 75 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 EPS 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 Provide butt welding fittings in stainless steel pipelines less than 75 mm of the same class as the pipe, conforming to ASTM A403 and ANSI B16.11. Provide socket welding fittings in stainless steel pipelines less than 75 mm to Cl. 3000, same material as the pipe, and ANSI B16.1 1. Fabricate fittings in stainless steel pipelines equal to or greater than 75 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.

2.12 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.
.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 (F7712400), 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 F1 52), 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-Type2: 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 75 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 75 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.

2.13 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 bolts and nuts conforming to ASTM A307, Grade A; nuts conforming to ASTM A563, Gr.A.

.3 For exposed (exterior), submerged, buried, installed below the main floor slab and concrete encased service, provide stainless steel bolts, nuts and washers; 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.

2.14 ANCHOR BOLTS

.1 Provide hot dip galvanized, L – type anchor bolts, nuts and washers for use with concrete support blocks.

.2 Use bolts and nuts conforming to ASTM A307, Grade A; nuts conforming to ASTM A563, Grade A.

.3 Refer to the standard drawings at the end of this section.

2.15 EPOXY COATING (INTERIOR/EXTERIOR PIPING & VALVE SURFACES)

.1 General

.1 All coatings shall be to AWWA C210, ANSI/NSF 60/61 suitable for use in potable water applications.
.2 All coatings shall be factory applied by the fitting, piping or valve manufacturer or by a specialized coating firm approved by the Owner’s Representative.
.3 Coat all non-galvanized/non-stainless steel surfaces in contact with water.

.2 Coating Materials and Applications

.1 Coating Material: The coating material shall be a two component, epoxy liquid coating suitable for use in potable water applications.
.2 Application: The coating shall be cold applied and holiday free in accordance with the coating manufacturer's specifications.

.3 Surface Preparations

.1 All surfaces shall be blast cleaned to SSPC-SP5 prior to and within 4 hours of coating. Newly cast objects need not to be sandblasted if not contaminated with soil, oil, grease etc. and if coating takes place within 4 hours after casting.

.4 Field Applied Coatings

.1 Apply to damaged areas of shop coated surfaces and at field welds.
.2 Clean and prepare surfaces in accordance with the manufacturers recommendations.
.3 Repair coating with an epoxy compatible with the factory-applied epoxy and finish in accordance with the coating manufacturers specifications.

.5 Inspection

.1 The coating shall be pinhole free.
.2 The Owner reserves the right to obtain independent coating testing.
.3 The cost of independent coating testing shall be born by the Owner unless the inspection was requested by the Contractor.
.4 If the independent test shows that the coating is unacceptable, the Contractor shall bear the full cost of all testing and reapplication to the satisfaction of the Owner.

.6 Color Schedule

.1 All piping, valves, and equipment shall be color coded and the finish colors shall be as shown on the color schedule in Section 9907 or as directed by the Engineer.

.7 Acceptable product

.1 Devoe BAR-RUST 233H (NSF approved) Multi-Purpose Epoxy Coating, DFT 12 - 16 mils.
.2 Or approved alternate.

2.16 FIELD APPLIED COATING AND WRAPPING

.1 Buried steel piping shall have an external protective wrapping to protect against corrosion. The wrapping shall consist of a primer followed by a polyken tape covering and then a polyethylene rock shield. The system of primer and tape shall conform to AWWA C209.

.2 The tape shall be a polyken tape with butyl rubber backing.

.3 Primer shall have a base of rubber and synthetic resins, compatible with tape, and suitable for hand application.

.4 The rock shield shall be black polyethylene, 40-mil thickness, supplied in rolls 1050-mm wide, Renfrew 350-40 or as approved.

.5 Buried steel flanges shall have an external protective wrapping to protect against corrosion. The wrapping shall consist of a primer followed by a Denso tape covering.

2.17 GALVANIZING

.1 Where piping is to be galvanized, hot dip zinc coat to CSA G164 with a minimum coating of 550 g/m^2.

2.18 RPVC CONDUIT

.1 Tubing shall be installed in RPVC conduit where indicated on Contract Drawings.

.2 Tubing of 10 mm diameter and smaller is to be installed in 25 mm diameter RPVC conduit complete with long radius elbows.

.3 Tubing of 12 mm diameter to be installed in 50 mm diameter RPVC conduit complete with long radius elbows.

2.19 TRACER WIRE

.1 Buried nonmetallic piping shall be installed with insulated tracer wire.

.2 Insulated tracer wire; 2.0mm (14 gauge) shall be placed above the pipeline and directly over the centre of the pipeline. The Contractor must ensure that the tracer wire is not cut, scraped, or nicked during installation. Termination points shall be installed on Pipeline Warning Sign Posts at approximately 2 km spacing.

.3 The Contractor shall test and the Engineer shall check the tracer wire. It shall be the Contractor's responsibility to locate and repair any malfunctions discovered by either the Contractor or the Engineer.

2.20 PIPE HANGERS AND SUPPORTS

.1 General:

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 1983 and MSS-SP58-1983.
.2 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
.3 Dielectrically isolate all piping from dissimilar metal supports.

.2 Upper Attachments:

.1 Concrete:

.1 Inserts for cast-in-place concrete: galvanized steel wedge to MSS-SP58-1983, type 18. ULC listed for pipe 20 mm size through 200 mm.

.1 Acceptable product: Anvil Fig. 281; Myatt.

.2 Carbon steel plate with clevis, for surface mount - malleable iron socket, expansion case and bolt. Minimum two expansion cases and bolts for each hanger.

.1 Acceptable product: Anvil - Fig. 49, Socket Fig. 290, Expansion Case Fig. 117; Myatt.

.2 Steel Beam (bottom flange):

.1 Cold piping 50 mm size or smaller: malleable iron C clamp to MSS-SP58-198 type 19, ULC listed.

.1 Acceptable product: Anvil Fig. 61; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: malleable iron beam clamp to MSS-SP58-1983 type 28 or 29, ULC listed.

.1 Acceptable product: Anvil Fig. 229; Myatt.

.3 Steel Beam (top):

.1 Cold piping 50 mm size or smaller: malleable iron "top of beam" clamp to MSS-SP58-1983 type 19, ULC listed.

.1 Acceptable product: Anvil Fig. 61; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP58-1983 type 25, ULC listed.

.1 Acceptable product: Anvil Fig. 227: Myatt.

.4 Steel Joist:

.1 Cold piping 50 mm size and smaller: steel washer plate with double locking nuts.

.1 Acceptable product: Anvil Fig. 60; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket.

.1 Acceptable product: Anvil - washer plate Fig. 60, clevis Fig. 66, socket Fig. 290, Myatt.

.5 Steel Channel or Angle (bottom):

.1 Cold piping 50 mm size and smaller: malleable iron C clamp to MSS-Sp58-1983 type 23, ULC listed.

.1 Acceptable product: Anvil Fig. 86; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: universal channel clamp, ULC listed.

.1 Acceptable product: Anvil 226; Myatt.

.6 Steel Channel or Angle (top):

.1 Cold piping 50 mm size or smaller: malleable iron "top of beam" C clamp to MSS-SP58-1983 type 19 ULC listed.

.1 Acceptable product: Anvil Fig. 61; Myatt.

.2 Cold piping 65 mm size and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer, to MSS-SP58-1983 type 25, ULC listed.

.1 Acceptable product: Anvil Fig. 227: Myatt.

.3 Middle Attachment (rod):

.1 Carbon steel threaded rod, electro-galvanized for finish.

.1 Acceptable product: Anvil Fig. 146: Myatt.

.4 Pipe Attachment:

.1 Cold piping, steel or cast iron: hot piping, steel with less than 25 mm horizontal movement: hot piping, steel with more than 300 mm middle attachment rod length: adjustable clevis to MSS-SP58-1983 type 1, ULC listed.

.1 Acceptable product: Anvil Fig. 260; Myatt.

.2 Cold piping, hot copper with less than 25 mm horizontal movement; hot copper with more than 300 mm middle attachment rod length: adjustable clevis to MSS-SP58-1983 type 1, copper plated.

.1 Acceptable product: Anvil Fig. CT-65; Myatt.

.3 Suspended hot piping, steel and copper with horizontal movement in excess of 25 mm; hot steel with middle attachment rod 300 mm or less: pipe roller to MSS-1983 type 43.

.1 Acceptable product: Anvil Fig. 181; Myatt.

.4 Bottom supported hot piping, steel or copper: pipe roller stand to MSS-SP58-1983 type 45.

.1 Acceptable product: Anvil Fig. 271; Myatt.

.7 Riser Clamps:

.1 Steel or cast iron pipe: galvanized carbon steel to MSS-SP58-1983 type 42, ULC listed.

.1 Acceptable product: Anvil Fig. 261; Myatt.

.2 Copper pipe: carbon steel copper finished to MSS-SP58-1983 type 42.

.1 Acceptable product: Anvil Fig. CT-121; Myatt.

.8 Strut Mounted (galvanized carbon steel):

.1 Copper piping: cushion clamp c/w thermoplastic rubber.

.1 Acceptable product: Anvil PS1400; Hydra-Zorb.

.9 Saddles and Shields:

.1 Cold piping 30 mm and larger: protection shield with high density insulation under shield with interrupted vapour barrier.

.1 Acceptable product: Anvil Fig. 167; Myatt.

.2 Hot piping 30 mm size and larger: protective saddle with insulation under saddle.

.1 Acceptable product: Anvil Fig. 160 to 166; Myatt.

2.21 DUCT HANGERS AND SUPPORTS

.1 Hangers: Galvanized steel band iron or rolled angle and 10 mm rods.

.2 Wall Supports: Galvanized steel band iron or fabricated angle bracket.

.3 Vertical Support at Floor: Rolled angle.

2.22 RACK AND TRAPEZE SUPPORTS

.1 Provide steel trapeze and pipe rack components having a minimum thickness of 2.7 mm (12 gauge) with a maximum deflection of 1/240 of the span unless otherwise noted.

.2 Provide trapeze pipe support cross members and general fittings as required.

.3 Approved Supplier:

.1 Unistrut or approved equal.

2.23 FINISHES ON HANGER RODS, HANGERS AND SUPPORTS

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

2.24 INSTRUMENT AIR CONNECTIONS

.1 Provide instrument air connections to each instrument with a run of 6 mm nylon 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 1,500 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.

2.25 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
.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, two lug, malleable iron, female NPT: Dixon Air King.
.2 For 38 mm and 50 mm diameter hose, two four lug, malleable iron, female NPT: New Line Dixon Air King.
.3 For 75 and 100 mm diameter or greater; quick-acting, dual clip: Rite-pro, Dixon.

2.26 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 percent. Locate flushing connections adjacent to all isolation valves, on dead end branches, at tees and 90 degree elbows, and

at intermediate locations which limit the distance between flushing connections to less than 30 metres. Show flushing connections on piping submittals.

.2 Allow for 5 – 12.5 mm sample ports tapped into 150 to 300 mm pipes. Engineer will provide location during commissioning.

2.27 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 mrn NPS pipe, fitted with a shut off valve which shall be capped.

2.28 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)
.3 Victaulic Mechanical T

2.29 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.

2.30 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40°C for open housing and 50°C for drip proof housing, and operate at 1200 or 1800 r/min unless otherwise specified.

.3 Motors shall have ball or roller type bearings.

.4 Provide grease lubrication fittings on motors with frame sizes 254T and larger.

.5 Refer to electrical specification for voltage, phase and cycle.

2.31 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW: standard adjustable pitch sheaves, having +/- 10% range. Use mid-position of range for specified r/min.

.4 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.5 Motor slide rail adjustment plates to allow for centre line adjustment.

2.32 GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives:

.1 Expanded metal screen welded to steel frame.
.2 Minimum 1.2 mm sheet metal tops and bottoms.
.3 38 mm diameter holes on both shaft centers for insertion of tachometer.
.4 removable for servicing.
.5 Install guards to allow movement of motors for adjusting belt tension.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Guard for flexible coupling:

.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
.2 Securely fasten in place.
.3 Removable for servicing.

.5 Unprotected inlets and outlets:

.1 Wire or expanded metal screen, galvanized, 19 mm mesh.
.2 Net free area of guard: not less than 80% of fan openings.
.3 Securely fasten in place.
.4 Removable for servicing.

2.33 SPARE PARTS AND SPECIAL TOOLS

.1 Supply Spare Parts as follows.

.1 One set of belts for each piece of machinery.
.2 One filter cartridge or set of filter media for each filter or filter bank in addition to the final operating set.

.2 Provide one set of special tools required to service equipment as recommended by the equipment manufacturer.

2.34 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting, and servicing.

.2 Flush mounted 600 mm x 600 mm for body entry and maximum size possible to 300 mm x 300 mm for hand entry unless otherwise noted. Doors to open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.3 Material:

.1 Special areas such as tiles or marble surfaces: use stainless steel with brushed satin or polished finish as directed by consultant.
.2 Remaining areas: use prime coated steel.

.4 Installation:

.1 Locate such that all concealed items are accessible.
.2 Locate such that hand or body entry is achieved.
.3 Installation is specified in applicable sections.

2.35 FLASHING

.1 Steel Flashing: 0.55 mm galvanized steel.

.2 Lead Flashing: sheet lead, as follows:

.1 For Waterproofing: 25 kg/m^2.
.2 For Soundproofing: 5 kg/m^2.
.3 Lead Sheet Size:

.1 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.
.2 Floor Drains: minimum 920 x 920 mm and as specified.
.3 Other Locations: as specified.

.3 Safes: 25 kg/m^2 sheet lead or 200 micrometre neoprene.

.4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.36 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment, and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting, and servicing of all systems and equipment during regular work hours, prior to acceptance.

2.37 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the engineer of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

3. EXECUTION

3.1 EXAMINATION

.1 Examine areas where work is to be performed for:

.1 Anything that affects execution and quality of work.
.2 Piping clearances.

3.2 VALVES AND EQUIPMENT IDENTIFICATION

.1 Tagging:

.1 See Section 1.11.

.2 The drawings designate the size and line service specification of all pipe, fittings, valves and equipment to be supplied by the Contractor in the following manner.

.3 Valve Identification Symbols

.1 Valve Identity Symbols

Symbol	Valve Type
ARV	Air Release Valve
BAV	Ball Valve
BBV	Block and Bleed Valve
BPV	Back Pressure Valve
BUV	Butterfly Valve
BV	Block Valve
CAV	Combination Air Vacuum
CHV	Check Valve
DCVA	Double Check Valve Assembly
FCV	Flow Control Valve
GAV	Gate Valve
GLV	Globe Valve
NEV	Needle Valve
PRV	Pressure Reducing Valve
PSV	Pressure Sustaining, Pressure Relief Valve
SV	Solenoid Valve

.2 Valve Marking
Each valve to bear the manufacturer's name or trademark and reference symbol to indicate the service conditions for which the manufacturer guarantees the valve. The marking to be in accordance with MSS-SP-25.

.3 Manual Valve Actuators

.1 Actuators for valves to be as follows:

Type of Valve	Size	Valve Actuator
Gate Valve	250 mm & smaller	Handwheels
Globe Valve	250 mm & smaller	Handwheels
Butterfly Valves	100 mm & smaller	Lever operated
	150 mm & larger	Gear operated
Ball Valves	100 mm & smaller	Lever operated
Plug Valves	100 mm & smaller	Lever operated
	150 mm & larger	Gear Operated

.4 Valve operators to turn in a counter-clockwise direction to open unless otherwise indicated on the drawings.

.4 Equipment Identification

.1 Processes

Symbol	**Equipment**
AC	Air Compressor
B	Blower
EXP	Expansion Joint
FI	Flow Indicator
M	Mixer
PI	Pressure Indicator
P	Pump
SK	Skimmer
STR	Strainer
TK	Tank

.2 Plumbing

Symbol	**Equipment**
CO	Cleanout
DWH	Domestic Water Heater
ED	Equipment Drain
FD	Floor Drain
FFD	Funnel Floor Drain
FSL	Flow Switch
HB	Hose Bibb
HD	Hub Drain
NFHB	No Freeze Hose Bib
PTK	Pressure Tank
PS	Pressure Switch
RD	Roof Drain

.3 Heating, Ventilation, and Air Conditioning

Symbol	Equipment
B	Boiler
BDD	Back Draft Damper
CC	Cooling Coil
CF	Ceiling Fan
CU	Condensing Unit
DM	Damper
EF	Exhaust Fan
ET	Expansion Tank
FC	Fan Coil Unit
FF	Force Flow Unit
GC	Glycol Fill Tank
L	Louvre
P	Pump
SF	Supply Fan
T	Thermostat
UH	Unit Heater

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 (when required), identification, and service access, on 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 metal 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.

.14 Install dielectric fittings wherever piping of dissimilar metals are joined.

.15 Install flanges or unions to permit removal of equipment and valves without disturbing piping systems, as required by piping standard.

.16 Clean ends of pipes or tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.

.17 Support piping during construction to prevent abnormal stresses on the pipe works.
.18 Install pipe supports as required.
.19 Install pipe hangers as required.

.2 Flanges Bolting to Valves:

.1 Do not weld adjacent flanges when any 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.

.4 Threaded Connections:

.1 Clean pipe ends and threads.
.2 Use appropriate pipe dope for potable use when threading pipe.

3.4 WELDING SPECIFICATIONS

.1 Welders Qualifications:

.1 All welders shall have an Alberta Class "B" Pressure Welding Certificate. Welders shall be qualified by a local approved testing agency. All welders shall have qualified under ASME B31.1-2006 Standard
.2 All welders shall be qualified for the particular welding procedures they will perform.

.2 Welding Procedures:

.1 Submit details of the procedures for Owner’s Representative's review.
.2 All welding shall be carried out in accordance with ASME B31.3-2006 Standards.
.3 The Contractor shall use adequate weather shields to protect the welding operation from rain, snow and wind. The Owner’s Representative has the right to stop all welding if in his opinion adverse weather conditions will affect the quality of the weld.
.4 All dirt and slag shall be removed before the succeeding bead is applied.

.5 Welding of Stainless Steel:
.1 All welding of the root pass of austenitic stainless steel pipe shall be done using the Gas Tungsten Arc Welding (GTAW) or Gas Metal Arc

Welding (GMAW) process with appropriate filler metal and shielding gas.

.2 Preparation and welding in accordance with ASME B31.3 Section V.

.3 Fabrication shall be in accordance with ASME B31.3 Inspection code shall be Category D.

.4 Post weld cleaning: All stainless steel fabrications and welds shall be pickled in accordance with AWWA C220, ASTM A380 and ASTM A967. Stainless piping welds shall be coated with the appropriate pickling paste or immersed in a liquid bath of pickling solution. Any pickling product for use on piping for a potable system shall be NSF certified. Any noticeable discoloration found on the stainless pipe shall be removed by pickling.

.5 Field Welding of Stainless Steels:

.1 Field welding shall conform to ASME B31.3.

.2 Field welding shall be kept to a minimum and performed only with the prior consent of the Engineer.

.3 Stainless steel pipe shall be cleaned with alcohol or acetone to a pre-weld zone extending 50 mm on either side of the weld.

.3 Standard of Acceptability:

.1 The Engineer shall have the right to inspect all welds by visual, radiological or other non-destructive test method. Inspection may be made during welding or after the weld has been completed. Under visual examination welds shall be free of cracks, inadequate penetration, unrepaired burn-through and other defects, and shall present a neat workmanlike appearance. Radiological examination may be used at the discretion of the Owner's Representative to determine the penetration, slag inclusion, cracks and other defects. The Owner's Representative shall be the sole judge as to the acceptability of each weld.

.2 If a dispute results as to the acceptability of a weld, a specimen may be taken of the weld at the location determined by the Owner's Representative and subjected to tests in accordance with ASME B31.3-2006 Standards. An acceptable weld shall be per Z183.

.3 If the specimen test shows that the weld is unacceptable as outlined above, the Contractor shall bear the full cost of all testing and repairing the pipe where the specimen is removed to the satisfaction of the Owner's Representative. The Owner's Representative shall have the right to reject any weld if in his opinion the weld defects are detrimental to the strength of the weld.

.4 The cost of all radiological inspection shall be born by the Owner unless the inspection was requested by the Contractor.

.4 Leakage Testing:

.1 Leakage testing on completed butt joints shall normally be made by testing the line hydrostatically to the pressure rating of the pipe or as specified by design in hydrostatic testing specification.

.5 Repair of Defective Welds:

.1 Minor defects in welds may be removed by grinding out the defective portion. Replacement welds in joints may be checked by repeating the original test.

.2 Major defects and all cracks shall be cut out mechanically and the joint re-welded.

.3 All cost for repairing defective welds, including radiographic inspection of the corrected work, shall be borne by the Contractor.

3.5 VALVE 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 competent personnel and in strict accordance with manufacturer's instructions.

.2 Inspect pipe and remove all foreign debris or objects that may prevent closing of valve prior to the installation of any valves.

.3 Install butterfly valves with their operating shafts in the horizontal position unless otherwise directed by the Owner’s Representative.

.4 Flanges or fittings adjacent to butterfly valves shall not be welded with the valve in place.

3.6 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.7 PIPE HANGERS AND SUPPORTS

.1 Hanger Spacing

Spacing and middle attachment rod diameter as specified in paragraphs below or as table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of the Plumbing Code for the Province of Alberta or authority having jurisdiction.
.2 Fire protection: to applicable fire code.
.3 Gas piping: up to 15 mm size - every 1.8 m.
.4 Copper piping: up to 15 mm size - every 1.5 m.
.5 PVC piping: To manufacturer's recommendation for the maximum temperature of the service and to prevent any visible deflection or movement.
.6 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
.7 Within 300 mm of each horizontal elbow.
.8 Table:

Maximum Pipe Size(mm)	Rod Diameter (mm)	Maximum Spacing Steel (m)	Maximum Spacing Copper (m)
To 30	10	2.1	1.8
40	10	2.7	2.4
50	10	3.0	2.7
65	10	3.6	3.0
75	10	3.6	3.0
100	16	4.2	3.6
150	22	5.1	
200	22	5.7	
250	22	6.6	
300	22	6.9	

.2 Hanger Installation:

.1 Offset Hanger so that rod is vertical in operating position.
.2 Adjust hangers to equalize load.

3.8 EQUIPMENT BASES AND SUPPORTS

.1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

3.9 LOW VELOCITY DUCT HANGERS AND SUPPORTS

.1 Hanger Minimum Sizes:

.1 Up to 750 mm wide: 25 x 1.6 mm at 3 m spacing.
.2 790 to 1200 mm wide: 40 x 1.6 mm at 3 m spacing.
.3 Over 1200 mm wide: 40 x 1.6 mm at 2.4 m spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

.1 Up to 450 mm wide: 40 x 1.6 mm or 25 x 25 x 3 mm at 2.4 m spacing.
.2 480 x 1000 mm wide: 40 x 40 x 3 mm at 1.2 m spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes at 3.65 m spacing:

.1 Up to 610 mm wide: 40 x 1.6 mm.
.2 640 to 900 mm wide: 25 x 25 x 3 mm.
.3 Over 1520 mm wide: 50 x 3 mm.
.4 940 to 1200 mm wide: 30 x 30 x 3 mm.

.4 Vertical Duct Floor Supports Minimum Sizes, riveted or screwed to ducts:

.1 Up to 1520 mm wide: 40 x 40 x 3 mm.
.2 Over 1520 mm wide: 50 x 3 mm.

3.10 FLASHING

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

.2 Flash vent and soil pipes projecting 75 mm minimum above roof membrane with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead minimum 250 mm clear on sides. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations, minimum 200 mm high.

.5 Attach counterflashings to mechanical equipment and lap base flashings on roof curbs.

.6 All joints in counterflashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Use storm collars above all roof jacks.

.7 Screw vertical flange section of roof jacks to face of curb.

.8 Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.11 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.

3.12 EQUIPMENT PIPING CONNECTIONS

.1 Where equipment connections are a different size from the piping serving it all associated isolating valves and fittings to be the larger pipe size unless specifically indicated otherwise on the drawings. This rule to also apply in the case of control valves.

3.13 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 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.3 Standard sleeves to be 22 Ga. galvanized sheet steel with lock seam joints.

.4 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.

.5 Sizes:

.1 Refer to mechanical drawings for details.
.2 Provide 6 mm clearance all around, between sleeves and pipe or between sleeve and insulation.

.6 Terminate sleeves flush with surface of concrete and masonry and above floors.

.7 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.

.8 Voids Around Pipes:

.1 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.
.2 Ensure no contact between copper tube or pipe and ferrous sleeve.
.3 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

.9 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 CGSB19-GP-9.

3.14 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.

3.15 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 SECTION

1. GENERAL

1.1 REFERENCE DOCUMENTS

.1 Pipe supports shall meet the requirements of ANSI/ASME B31.1-1995, Power piping.

.2 Duct hangers shall follow the recommendations of the SMACNA Duct Manuals.

1.2 GENERAL REQUIREMENTS

.1 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.

.2 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.

.3 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.

.4 Fasten hangers and supports to building steel or inserts in concrete construction.

.5 Provide and set sleeves required for equipment, including openings required for placing equipment.

.6 Dielectrically isolate dissimilar metals.

.7 Pipe, duct and conduit supports are not all necessarily shown on the Contract Drawings. The Contractor is responsible to ensure sufficient supports are supplied, fabricated, and installed to properly secure all pipe, fittings, and equipment to satisfy manufacturer’s recommendations.

1.3 APPROVALS

.1 Obtain approval from the Engineer prior to drilling for inserts and supports for piping systems.

.2 Obtain approval from the Engineer prior to using percussion type fastenings.

.3 Use of perforated band iron, wire or chain as hangers is not permitted.

2. PRODUCTS

2.1 INSERTS

.1 Inserts shall be galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms.

.2 Size inserts to suit threaded hanger rods.

2.2 PIPE HANGERS AND SUPPORTS

.1 Hangers: Pipe sizes 15 mm to 40 mm: Adjustable wrought steel ring.

.2 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes 150 mm Over: Adjustable wrought steel clevis.

.3 Hangers: Hot Pipe Sizes 150 mm: Adjustable steel yoke and cast iron roll.

.4 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe sizes 150 mm and over.

.5 Wall Support: Pipe Sizes to 80 mm: Cast iron hook.

.6 Wall Support: Pipe Sizes 100 mm and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm and over.

.7 Vertical Support: Steel riser clamp.

.8 Floor Support: Pipe Sizes to 100 mm and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.9 Floor Support: Hot Pipe Sizes 150 mm and over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

.10 Design hangers so they cannot become disengaged by movements of supported pipe.

.11 Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

.12 Insulate all piping from dissimilar metal supports.

2.3 HANGER RODS

.1 Provide steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

2.4 DUCT HANGERS AND SUPPORTS

.1 Hangers: Galvanized steel band iron or rolled angle and 10 mm rods.

.2 Wall Supports: Galvanized steel band iron or fabricated angle bracket.

.3 Vertical Support at Floor: Rolled angle.

2.5 FLASHING

.1 Steel Flashing: 0.55 mm galvanized steel.

.2 Lead Flashing: sheet lead, as follows:

.1 For Waterproofing: 25 kg/m^2.

.2 For Soundproofing: 5 kg/m^2.

.3 Lead Sheet Size:

.1 Roof Plumbing Vents: as required to provide base flashing overlap to ARCA detail.

.2 Floor Drains: minimum 920 x 920 mm and as specified.

.3 Other Locations: as specified.

.3 Safes: 25 kg/m^2 sheet lead or 200 micrometre neoprene.

.4 Caps: Steel, 0.70 mm thickness minimum, 1.6 mm thickness at fire resistance structures.

2.6 SLEEVES

.1 Pipes through Floors: Form with 1.2 mm galvanized steel.

.2 Pipes through Beams, Walls, Fire Proofing, Footings, Potentially Wet Floor: Form with steel pipe or 1.2 mm thickness galvanized steel.

.3 Round Ducts: Form sleeves with galvanized steel.

.4 Rectangular Ducts: Form sleeves with galvanized steel or wood.

.5 Size large enough to allow for expansion with continuous insulation.

2.7 FINISHES ON HANGER RODS, HANGERS AND SUPPORTS

.1 All steel hanger rods, hangers and supports shall be galvanized or factory primed with alkyd red oxide primer to CAN/CGSB-1.40-M89.

3. EXECUTION

3.1 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm or ducts over 1500 mm wide.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.2 PIPE HANGERS AND SUPPORTS

.1 Support horizontal steel and copper piping as follows:

Nominal Pipe Size	Distance Between Supports	Hanger Rod Diameter
15 mm	1.8 m	10 mm
20 mm to 40 mm	1.8 m	10 mm
50 mm & 65 mm	3.0 m	10 mm
80 mm & 100 mm	3.6 m	16 mm
150 mm to 300 mm	4.3 m	22 mm
350 mm to 450 mm	6.1 m	25 mm

.2 Install hangers to provide minimum 12 mm clear space between finished covering and adjacent work.

.3 Place a hanger within 300 mm of each horizontal elbow.

.4 Use hangers which are vertically adjustable 40 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

3.3 LOW VELOCITY DUCT HANGERS AND SUPPORTS

.1 Hanger Minimum Sizes:

.1 Up to 750 mm wide: 25 x 1.6 mm at 3 m spacing.

.2 790 to 1200 mm wide: 40 x 1.6 mm at 3 m spacing.

.2 Horizontal Duct on Wall Supports Minimum Sizes:

.1 Up to 450 mm wide: 40 x 1.6 mm or 25 x 25 x 3 mm at 2.4 m spacing.

.2 480 x 1000 mm wide: 40 x 40 x 3 mm at 1.2 m spacing.

.3 Vertical Duct on Wall Supports Minimum Sizes at 3.65 m spacing:

.1 Up to 610 mm wide: 40 x 1.6 mm.

.2 640 to 900 mm wide: 25 x 25 x 3 mm.

.3 940 to 1200 mm wide: 30 x 30 x 3 mm.

.4 Vertical Duct Floor Supports Minimum Sizes, riveted or screwed to ducts:

.1 Up to 1520 mm wide: 40 x 40 x 3 mm.

3.4 EQUIPMENT BASES AND SUPPORTS

.1 Provide for major equipment, reinforced concrete housekeeping bases poured directly on structural floor slab 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

.2 Construct supports of structural steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

.3 Rigidly anchor ducts and pipes immediately after vibration connections to equipment.

3.5 FLASHING

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

.2 Flash vent and soil pipes projecting 75 mm minimum above roof membrane with lead worked 25 mm minimum into hub, 200 mm minimum clear on sides. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead minimum 250 mm clear on sides. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations, minimum 200 mm high.

.5 Attach counterflashings to mechanical equipment and lap base flashings on roof curbs.

.6 All joints in counterflashings shall be flattened and soldered double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Use storm collars above all roof jacks.

.7 Screw vertical flange section of roof jacks to face of curb.

.8 Provide lead flashing around ducts and pipes passing from equipment rooms, installed according to manufacturer's data for sound control.

3.6 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping or ductwork passes through floor, ceiling or wall, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Install chrome plated escutcheons where piping passes through finished surfaces.

END OF SECTION

1. GENERAL

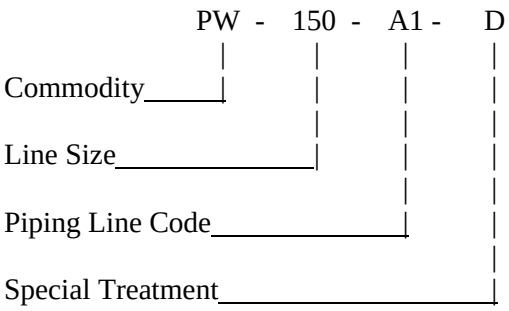
1.1 INTENT

.1 This section contains detailed piping specifications.

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 is placed on each line in the following manner:



e.g. potable water, 150 mm line size, standard weight steel, internal epoxy coated

.2 Legends and tables identifying the commodity, line code and special treatment symbols are included in this section of the specifications.

.1 Commodity Symbols for Line Identification:

AA	Aqua Ammonia
ACI	Acid (pH Adjustment)
ACS	Powdered Activated Carbon Solution
AD	Air Distribution
AS	Air Supply
AL	Alum
ALS	Alum Solution
ALG	Algaecide Solution
AMG	Ammonia Gas
AMS	Ammonia Solution
BWS	Backwash Supply
CA	Citric Acid
CAS	Citric Acid Solution
CDG	Carbon Dioxide Gas
CDS	Carbon Dioxide Solution
CIPS	Clean in Place Supply
CIPR	Clean in Place Return
CIPD	Clean in Place Drain
CLG	Chlorine Gas
CLS	Chlorine Solution

CO	Coagulant
COS	Coagulant Solution
CS	Caustic Soda
DCW	Domestic Cold Water
DHW	Domestic Hot Water
DHWR	Domestic Hot Water Recirculation
DE	DAF Effluent
DW	DAF Waste
DL	Diesel Fuel
DR	Drain
EW	Effluent Water
FL	Fluoride
FTW	Filter to Waste
FW	Filtered Water
G(H)	Natural Gas (High Pressure)
G(L)	Natural Gas (Low Pressure)
GLS	Glycol Supply
GLR	Glycol Return
HWS	Hot Water Supply
HWR	Hot Water Return
IA	Instrument Air
OF	Overflow
PLY	Polyelectrolyte (Liquid)
PLYS	Polyelectrolyte Solution
PO	Polymer
POS	Polymer Solution
PPS	Potassium Permanganate Solution
PSW	Plant Service Water
PW	Potable Water
RAS	Return Activated Sludge
RF	Refrigerant
RJW	Reject Water
RW	Raw Water
S	Sanitary Waste
SAM	Sample Line
SAS	Soda Ash Solution
SB	Sodium Bisulphate
SEN	Sensing Line
SH	Sodium Hypochlorite
SLG	Sludge
SPSW	Softened Plant Service Water
SU	Supernatant
SV	Sanitary Vent
TEW	Tempered Effluent Waste
VE	Vent
WAS	Waste Activated Sludge
WT	Weeping Tile
XR	Excess Recirculation

.3 Line Codes:
The following is a description of the general line code classifications.

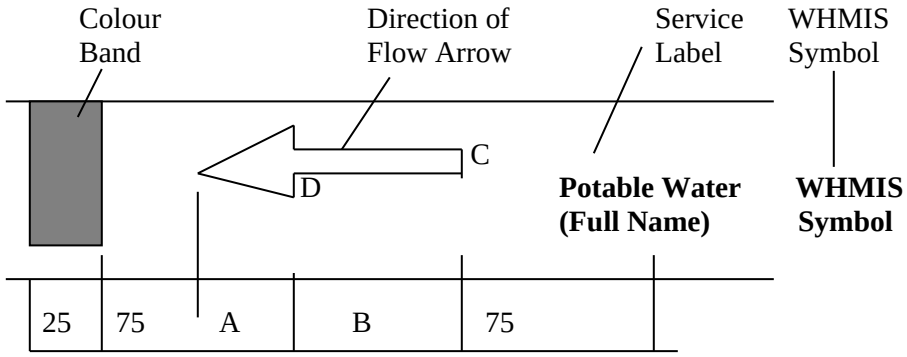
Line Code	Flange Rating	Schedule/ Thickness	Basic Material	Special Notes	Maximum Design Pressure
A1	ANSI 150	-	Carbon Steel	Standard Weight	Varies
A2	ANSI 150	-	Carbon Steel	Extra Strong	Varies
A3	ANSI 300	-	Carbon Steel	Extra Strong	Varies
B1	ANSI 150	Sch 80	PVC	-	Varies
B2	ANSI 150	Sch 40	PVC	-	Varies
B3	ANSI 150	SDR 18	PVC	-	1620 kPa
B4	ANSI 150	SDR 21	PVC	-	1380 kPa
B5	ANSI 150	SDR 26	PVC	-	1100 kPa
B6	ANSI 150	SDR 28	PVC	-	-
B7	ANSI 150	SDR 32.5	PVC	-	860 kPa
B8	ANSI 150	SDR 35	PVC	-	-
B9	ANSI 150	SDR 41	PVC	-	690 kPa
B10	ANSI 150	SDR 51	PVC	-	550 kPa
B11	ANSI 150	C900 & C 905	PVC	-	1050 kPa
B12	-	SCH 80	PVC (Well Riser Pipe)	Certa-Lock	-
C1	-	Type K	Copper	-	-
C2	-	Type L	Copper	-	-
C3	-	Type M	Copper	-	-
D1	ANSI 150	SCH 10S	Stainless Steel 304L	-	Varies
D2	ANSI 150	SCH 10S	Stainless Steel 316L	-	Varies
D3	ANSI 150	SCH 40S	Stainless Steel 304L	-	Varies
D4	ANSI 150	SCH 40S	Stainless Steel 316L	-	Varies
D5	ANSI 300	SCH 80S	Stainless Steel 304L	-	Varies
D6	ANSI 300	SCH 80S	Stainless Steel 316L	-	Varies
E1	-	-	PVC-DWV	-	Plumbing Code
E2	-	-	ABS-DWV	-	Plumbing Code
F1	-	-	Big “O” Drain	c/w filter sock	-
G1	ANSI 150	-	Ductile Iron	-	-
G2	ANSI 150	-	Cast Iron	-	-
H1	-	DR 9	HDPE, C906	-	1380 kPa
H2	-	DR 11	HDPE, C906	-	1100 kPa
H3	-	DR 13.5	HDPE, C906	-	900 kPa
H4	-	DR 15.5	HDPE, C906	-	760 kPa
H5	-	DR 17	HDPE, C906	-	690 kPa
H6	-	DR 32	HDPE, C906	-	315 kPa
H7	-	DR 11	PE2406, Yellow	-	522 kPa
J1	-	-	Asbestos Cement Pipe	-	-
J2	-	Class V	Reinforced Concrete Pipe	-	-
K1	-	-	PE OD Tubing	-	-
K2	-	-	PE ID Tubing	-	-
K3	-	-	LLDPE OD Tubing	-	-
K4	-	-	PP OD Tubing	-	-

.4 Special Treatment Code:

Symbol	**Description**
(A)	Cement mortar lining
(B)	Internal hot applied coal tar lining
(C)	External hot applied coal tar lining
(D)	Internal epoxy coated
(E)	External epoxy coated
(F)	External yellow jacketed
(G)	External double wrap polyken tape
(H)	Externally insulated
(J)	External shop prime
(K)	Densyl mastic wrap - buried flanges, couplers, and valves
(L)	Galvanized
(M)	Rock shield
(N)	Frost shield
(P)	Installed in RPVC conduit
(R)	Tracer wire installed above pipe

.5 Pipe Identification Symbols:

.1 The marking of the piping is to correspond to the following sketch:



.2 Sizing Requirements - The sizing and spacing of the various components in relation to the outside diameter of the pipe on which they are to be painted is to be as follows:

OUTSIDE DIA OF PIPE (OVER INSULATION)	A	B	C	D
12min - 25 mm	12mm	50mm	6mm	3mm
32 mm - 50 mm	25mm	75mm	2mm	6mm
64 mm and up	38mm	87mm	25 mm	12mm

.3 Application

.1 All pipeline identification symbols are to be adhesive labels.

.2 Surface of pipe or insulation, on which symbols are to be applied, must be clean and dry.

.4 Symbol Colours

.1 Colour **Band - width of colour band is to be** 25 mm on all diameters of pipe.

.2 Direction of Flow Arrow - arrow is to indicate direction of flow of media in pipe. If direction is either way, a double headed arrow is to be used as shown in "Sizing Requirements". Colour arrow is to be black when pipe is a light colour. Colour of arrow is to be white when pipe is a dark colour.

.3 Service Label – Labels are to designate what is in pipe.

.5 Location of Symbols- No hard and fast rules for the location of piping identification symbols are laid down, however some general requirements and guidelines are noted below.

.6 The purpose is to present the information to the maintenance person at the point in the building where it is likely to be needed.

.7 The maintenance person must not have to climb around objects, over pipes, etc., to read a pipe symbol. They shall be presented in such a manner that they are clearly visible when standing in a normal manner in the room or space. If the normal access to a space is above the pipes, then they should be identified on their tops so that they can be seen when looking down. The line of sight of the maintenance person shall always be kept in mind.

.8 Places for pipe identification are as follows:

.1 On lateral runs where they leave risers at various floor levels.

.2 On risers in pipe spaces near locations where entry to personnel is provided.

.3 Near valves or branches where a number of pipes are racked together on a pipe rack.

.4 Near pipe connection points to major pieces of equipment. Keep symbols far enough away so they would not get damaged by maintenance activity around equipment.

.5 Near major shut-off valves at entry point of utility to building.

.6 Near pipe exit point from building.

.9 Long runs of pipe in building shall be identified approximately every 15 m (50').

.10 A pipe passing through a wall should be identified on both sides of wall.

.11 Before undertaking the work, the Contractor is to complete a sample for viewing by the Consultant and Owner in order to obtain approval to proceed. The stencils prepared and the proposed paint are to be checked at that time by these parties.

SERVICE: Refer to Contract Drawings		LINE CODE: B2
PRIMARY FLANGE RATING: CLASS 150		DESIGN PRESSURE:
TEMPERATURE (MAX): 40°C		CORROSION ALLOWANCE:
ITEM	SIZES	GENERAL DESCRIPTION
Pipe	300 mm & smaller	PVC, rigid, to ASTM D 1785 and CSA B137.3, or NSF14. Sch. 40.
Fittings	300 mm & smaller	PVC, socket weld, to ASTM D 2467. Sch. 80.
Flanges	All sizes	Class 150, PVC socket weld.
Bolts (dry)	All sizes	To ASTM A193 Grade B7. To be plated for corrosion resistance.
Nuts (dry)	All sizes	Semi-finished, hex head, to ASTM A194 Grade 2H. To be plated for corrosion resistance.
Ball Valves	All sizes	PVC body and ball TFE seat, socket ends, true-union safe-block design, PTFE seats, viton O-ring seals, Chemline or as approved.
Check Valves	50 mm & larger	See Section 40 00 00:Mechanical General Requirements
Check Valves for chemical feed lines	38 mm & smaller	True Union Ball or Swing Check, Chemline or as approved
Butterfly Valves	75 mm to 1050 mm	See Section 40 00 00:Mechanical General Requirements
Air Release Valves	12 mm to 50 mm	See Section 40 00 00:Mechanical General Requirements
Needle valves	All sizes	316 Stainless steel, Century valves or approved equal
Unions	75 mm & larger	Use flanges
	65 mm & smaller	Use Class 150 PVC
Strainers	50 mm & smaller	Iron body, Y pattern, screwed, 20 mesh model screen, Crane No. 988 ½; Red-White/Toyo No. 380, SS screen, c/w BAV on Drain.

SERVICE: Refer to Contract Drawings		LINE CODE: B2
PRIMARY FLANGE RATING: CLASS 150		DESIGN PRESSURE:
TEMPERATURE (MAX): 40°C		CORROSION ALLOWANCE:
ITEM	SIZES	GENERAL DESCRIPTION
Pipe Couplings	65 mm & smaller	Use unions.
	75 mm & larger	The coupling type to be as shown on the drawings and to suit outside diameter of pipe .1 Victaulic Style 77 standard weight. .2 Use Victaulic adapters, length to suit pipe diameter.
Victaulic Gasket	All Sizes	Grade "M" seal ring to AWWA Standards.
Diaphragm Valves	40 mm & smaller	Class 150 PVC Type 1, Grade 1, Body with Neoprene or teflon diaphragm, true union, screwed, socket, Chemline, ITT Grinnel, Chemtrol.
Diaphragm Valves	50 mm to 150 mm	Class 150 PVC Type 1, Grade 1 with neoprene or teflon diaphragm, flanged, Chemline, ITT Grinnel, Chemtrol.

SERVICE: Refer to Contract Drawings		LINE CODE: K2
PRIMARY FLANGE RATING:		DESIGN PRESSURE:
TEMPERATURE (MAX): 40°C		CORROSION ALLOWANCE:
ITEM	SIZES	GENERAL DESCRIPTION
Tubing	6 mm – 25 mm	Polyethylene (PE) ID Tubing. Contractor to field confirm all tubing lengths and suitability for service.
Fittings	6 mm – 25 mm	Quick-disconnect (push to connect) fittings with acetal bodies, nitrile, O-rings, acetal collets. Rated for 150 psi (minimum)
Couplings	6 mm – 25 mm	Quick-disconnect (push to connect) fittings with acetal bodies, nitrile, O-rings, acetal collets. Rated for 150 psi (minimum)
Adapters	6 mm – 25 mm	Quick-disconnect (push to connect) to NPT threaded adapters with acetal bodies, nitrile, O-rings, acetal collets. NSF approved.
Ball Valves	12 mm – 25 mm	Chemline Type 21 true union ball valves with end connections suitable for connecting to tubing.
Back Pressure Valves	12 mm – 25 mm	Chemline SB10/11 series with end connections suitable for connecting to tubing.
Pressure Relief Valves	12 mm – 25 mm	Chemline SB10/11 series with end connections suitable for connecting to tubing.

END OF SECTION

1. GENERAL

1.1 INTENT

.1 This section of the specifications refers to the supply, installation and testing of manually operated valves used for isolation, throttling, relief, regulating, and for specialty valves including those requiring electric, hydraulic, or pneumatic actuation.

1.2 RELATED SECTIONS

.1 Section 01 33 01 – Project Record Documents

.2 Section 40 95 73 – Instrument Wiring

.3 Section 40 91 00 – Process Measurement Devices

.4 Section 40 00 00 – Mechanical General Requirements

.5 Section 40 05 40 – Detailed Piping Specifications

1.3 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to General Conditions for requirements pertaining to product options and substitutions.

1.4 VALVE SIZES

.1 Valves sizes are specified in preferred metric sizes.

1.5 SOURCE OF SUPPLY

.1 Valves of same type shall be by a single manufacturer.

1.6 DEFINITIONS

.1 Valve Identification

.1 Process piping valves are identified on the drawings by valve symbols. Refer to the Contract Drawings for lists of valve symbols and labels.

.2 Actuators

.1 Supply valves with standard operators as detailed herein, unless otherwise noted in the Contract Documents.

1.7 SUBMITTALS

.1 Technical data, specifications, dimensional drawings, and installation, operation and maintencence drawings for each type of valve, indicating valve number, materials of construction, dimensions, head loss characteristics through the valve, operating torque and valve end configuration.

1.8 SHOP DRAWINGS

.1 Comply with requirements of Section 40 00 00.

.2 Submit equipment schedule before ordering.

.3 Submit shop drawings in accordance with General Conditions.

.4 Include a complete list of all tag identifications.

1.9 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into the manual specified in Section 01 33 01 – Project Record Documents

.2 Include the reviewed tag lists

1.10 IDENTIFICATION

.1 Indicators shall bear the following information permanently marked on body:

.1 Manufacturer's name or trademark.
.2 Pressure rating.
.3 Flow direction.
.4 Serial number

1.11 TAGGING

.1 Provide each piece of equipment with a tag stamped or engraved with the appropriate equipment number, as listed in this Specification.

.2 Tags to be 20 mm high, 75 mm long and 1.5 mm thick, plastic Romark "Ultra Suede", 8mm high alphanumeric characters, Helvetica font (01040 cutter), reverse engraved. Characters to be white on coloured background. Background colour to be red.

.3 The code lettering and number system shall be as shown on the P & I drawings or as directed by the Engineer.

.4 Affix tags to equipment securely.

1.12 MATERIALS

.1 All 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 Where any standard referenced has been superseded prior to bidding, the Contractor shall comply with the current standard.

.4 Provide Canadian Registry Number (CRN) designated by the Province of Alberta for each valve type.

2. PRODUCTS

2.1 GENERAL

.1 Unless otherwise indicated, valves shall be the same size as the pipe run in which they are to be installed.

.2 Equipment Description

.1 All instruments are given a description "Tag #". The Tag # refers to the description relative to the P & I drawings and mechanical drawings for reference.

2.2 DRAWINGS

.1 Process and Instrumentation Drawings and Mechancial Drawings indicate location of valves and intent of operation.

.2 Detailed process drawings, HVAC drawings, process standard drawings, HVAC standard drawings, yard piping drawings and service piping schematics indicate the valves on the process schematics plus other valves required for isolation.

2.3 VALVE ENDS

.1 In pipe runs less than 50 mm diameter provide valves with female threaded ends, unless indicated otherwise. Threads to conform to ANSI B1.20.1.

.2 Valves in pipe runs equal to or greater than 50 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 Grooved joint valve ends are acceptable, where applicable.

.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 VALVE STEM EXTENSIONS

.1 Provide valve stem extensions where additional clearance is required or of 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.

2.5 SPARE PARTS

.1 Provide spare parts as recommended by manufacturer.

.2 Provide a list of all spare parts which would be expected to be required under normal conditions for a period of five years.

2.6 RESILIENT SEATED NON-BURIED GATE VALVES

.1 Applicable Equipment: GAV

.1 Liquid Type: Potable Water

.2 Valve Type: Lugged

.3 Location: Well Kiosk

.4 Valve Size: 75mm

.5 Specified Valves:

.1 Supplier: American AVK or approved equivalent
.2 Model: Resilient Seated Wedge Gate Valve Series 65
.3 Fluid Temperature: 1 to 25 ^{o}C
.4 Pressure Rating: 250 PSI
.5 Body: Ductile Iron
.6 Bonnet: Ductile Iron
.7 Stem: 316 stainless steel
.8 Shaft Seal: “O” ring
.9 Seal: NBR
.10 Wedge: EPDM encapsulated ductile iron wedge
.11 Bolting Materials: 316 stainless steel
.12 Coatings: Internal and external fusion bonded epoxy coating with NSF 61 approval

.2 Materials: All materials used in the valves and hydraulic operators shall be first class in every respect and shall be incorporated into the assembly in a workmanlike manner. Materials shall be completely suitable for the service intended and selected and fabricated in accordance with the best engineering practice.

.3 Testing: The Supplier shall furnish certified copies of reports describing the procedures and results of the Proof-of-Design test, performance test, leakage test and hydrostatic test for each valve. Delivery of any valve will not be accepted unless certified copies of the above tests have been received.

.4 Shipping and Storage: The Supplier shall ensure that all units are properly protected from dust, grease, moisture and any other materials which may harmfully affect the valves during storage and/or shipping.

.5 Operators: Valves not having electric, hydraulic, or pneumatic operators shall be equipped with manual operators and position indicators. The location of the manual operator and position indicator shall be specified by the Owner. The maximum operator effort under any condition shall be 316 kg (80 pounds) pull and shall turn a clockwise direction to close. Valves 100 mm and smaller shall be hand levers. Valves 150 mm and larger shall be worm gear operated complete with wheel operator.

.6 Gear operator to be worm gear type, equipped with a hand wheel and a visual indicator of the valve position. Equip 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 overtravel 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.

2.7 DUAL DISC CHECK VALVES

.1 Applicable Equipment: CHV

.1 Liquid Type: Potable Water

.2 Location: Well Kiosk

.3 Valve Type: Wafer

.4 Valve Size: 75 mm

.5 Specified Equipment:

.1 Manufacturer: Val-Matic or approved equivalent
.2 Model: Series No. 8803W.1XP
.3 Pressure Rating: 250 psi
.4 Body and Cover: Ductile Iron ASTM A536.
.5 Flange: 150 lb.
.6 Disc: Bronze ASTM A536
.7 Seal: Buna-N (NBR)
.8 Spring: 316 Stainless Steel
.9 Trim: 316 Stainless Steel
.10 Exterior Coating: ANSI/NSF 61 Fusion Bonded Epoxy
.11 Interior Coating: ANSI/NSF 61 Fusions Bonded Epoxy
.12 NSF 61 Approved

2.8 AIR RELEASE VALVE

.1 Applicable Equipment: ARV

.1 Location: Well Kiosk

.2 Liquid Type: Potable Water.

.3 Size: 25 mm inlet.

.4 Pressure Rating: 175psi

.5 Working Temperature: 1-25°C

.6 Floats and trim shall be 316 stainless steel.

.7 To be supplied with isolation ball valve and adjustable throttling device.

.8 Venting: Provide 19 mm vent gooseneck complete with hose connect to a floor drain.

.9 Valve to be epoxy coated and lined (NSF61 certified).

.10 Equip with soft seats for low pressure application

.11 Acceptable Manufacturer: Valmatic Model 15A.3DISV or approved equivalent.

2.9 BALL VALVE

.1 Applicable equipment: All ball valves

.1 Liquid Type : Potable Water

.2 Size: 75 mm and smaller.

.3 All operators shall turn in a clockwise direction.

.4 Specified Equipment: copper, steel, and stainless steel piping:

.1 Manufacturer: Crane or equivalent.
.2 Model: 600 CWP Figure 201J.
.3 Type: Ball Valve.
.4 Body: Brass.
.5 Nut: Brass.
.6 Handle: Steel.
.7 Gland: Brass.
.8 Stem Packing: PTFE.
.9 +Stem: Brass.
.10 Ball Disc Packing: PTFE.
.11 Ball: Chrome Plated.
.12 Connections: Solder or screwed.
.13 Pressure Rating: 1050 kPa (150 psi).

2.10 STRAINER

.1 Applicable Equipment: STR

.1 Location: Well Kiosk

.2 Liquide Type: Raw Water

.3 Minimum Required Pressure Range: 150 psi

.4 Specified Equipment:

.1 Manufacturer: Cla-Val
.2 Model: X43H
.3 Size: 75 mm
.4 Materials: Body & Cover: Ductile Iron ANSI B16.42; Fusion Bonded Epoxy.
.5 Coating Standard Cover Seal: Buna-N® Synthetic Rubber Strainer: 316 Stainless.
.6 Steel; Ductile Iron, Epoxy Coated Frame.
.7 Strainer Mesh Sizes: Standard 10 mesh.
.8 Drain/Blow-Off Connection Furnished with Stainless Steel Plug as Standard.
.9 Cover Fasteners: Stainless Steel.
.10 NSF 61 certified.

2.11 NEEDLE VALVE

.1 Applicable Equipment: NEV 210

.1 Liquid Type: Raw Water

.2 Location: Well Kiosk

.3 Valve Pattern: Globe

.4 Valve Size: 12 mm (1/2”)

.5 Specified Equipment:

.1 Manufacturer: Chemline or approved equivalent.
.2 Valve Material: PVC
.3 End Detail: Female NPT Threaded
.4 Stem Seals: Teflon PTFE

.6 Tag #: NEV 210

2.12 FLOW INDICATOR

.1 Applicable Equipment: FI 210

.1 Liquid Type: Raw Water

.2 Location: Well Kiosk

.3 Specified Equipment:

.1 Manufacturer: Chemline
.2 Model: FCA00060
.3 Inlet: 3/8” NPT.
.4 Outlet: 3/8” NPT.
.5 Tube: PVC

.6 O-Rings: EPDM
.7 Scale Range: 5 to 60 l/hr (0.02 to 0.26 USgpm)

.4 Approved Alternates:

.1 Blue-White
.2 King Instrument
.3 OMEGA

.5 Tag #s: FI 210

2.13 BALANCED DIRECT ACTING PRESSURE REDUCING VALVE

.1 Applicable Equipment: PRV 210

.1 Liquid Type: Raw Water

.2 Location: Well Kiosk

.3 End Detail: Threaded or Socket

.4 Valve Size: 12 mm (1/2”)

.5 Specified Equipment:

.1 Manufacturer: Cla-Val or approved equivalent.
.2 Model: 990
.3 Body Material: Bronze ASTM B62
.4 Strainer: 416 Stainless Steel
.5 Valve Trim: 416 Stainless Steel
.6 Diaphragm: Reinforced EPDM
.7 Disc: EPDM Rubber
.8 Ends: Dual Union Tailpieces, NPT Threaded
.9 Adjustment Range: 7 to 29 psi
.10 Setpoint: 7 psi
.11 Accessories:
.1 Pressure Gauge:
.1 Measures Downstream Pressure
.2 Range: 0 to 30 psig

.6 Tag #: PRV 210

2.14 TURBIDITY ANALYZER SOLENOID VALVE

.1 Applicable Equipment: FV 210

.1 Liquid Type: Raw Water

.2 Valve Size: 12 mm (1/2”)

.3 Location: Well Kiosk

.4 Operating Conditions:

.1 Fluid Temperature: 5 to 25°C.
.2 Pressure Maximum: 1050 kPa

.5 Specified Equipment:

.1 Supplier: Asco or equivalent
.2 Model: 8210G87
.3 Type: Two way pilot operated solenoid globe valve
.4 Operating Pressure Differential: 0 to 1050 kPa (150 psi)
.5 Body material: Brass
.6 Seal/Disc material: Buna "N"
.7 Power: 120 VAC, 60 Hz
.8 Energize to open
.9 Reset: none
.10 Action: Fast Acting

2.15 MOTOR OPERATED CONTROL VALVES

.1 Applicable Equipment: FV 213, 214

.1 Operating Conditions:
.1 Fluid: Raw Water.
.2 Fluid Temperature: 1 to 25 degree C.
.3 Maximum Flow: 3 L/s

.2 Valve Size: 75mm

.3 Location: Well Kiosk downstream of UV units

.4 Specified Equipment:

.1 Manufacturer: Bray or approved equivalent (valve to be NSF certified)
.2 Model: Series 31 (undercut to 50 psi)
.3 Type: Motor Operated Control Valve
.4 Valve Type: Butterfly lugged style
.5 Pressure Rating: valve to be undercut to 50 psi
.6 Body: Cast Iron
.7 Disc: Nylon 11 Coated Ductile Iron (NSF 61 approved), ASTM A536
.8 Seat: EPDM - Resilient
.9 Stem: 316 Stainless Steel
.10 Coatings: Internal and external epoxy coating with NSF 61 approval
.11 Actuator Model: Series 70 Open/Close
.12 Actuator Power: 120VAC single phase
.13 Actuator Control Input: On/Off Control
.14 Actuator Feedback: Auxiliary switches to indicate valve fully opened, valve fully closed, handwheel status (available for remote operation).
.15 Actuator Manual Handwheel: Required
.16 Actuator Torque Tube: Carbon steel with epoxy coating.

3. EXECUTION

3.1 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.

3.2 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 indentified, inform the Engineer and initiate the necessary piping modifications at no cost to the Owner.

3.3 INSTALLATION

.1 Install all equipment in strict accordance with manufacturer's and supplier's instructions.

.2 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.

.3 Make equipment installation and connections by skilled tradesmen to the best standard.

.4 Carry out work to produce a neat, accurate, secure, functional installation.

.5 Repair at own expense, any damage done to the installation of materials while carrying out the work.

.6 Install supports and bases in advance of equipment installation in accordance with manufacturer's instructions.

.7 Generally pipe supports and hangers are not shown unless for indication purposes only.

3.4 VALVE EXTENSIONS

.1 Install valve extensions where necessary to provide clearance from installation.

3.5 EQUIPMENT TESTING PROCEDURE

.1 Submit a thorough description of the procedures to be employed in testing this equipment. The procedure will be reviewed by the Engineer for suitability and should be submitted 3 weeks prior to any testing.

3.6 FIELD TESTING

.1 When equipment installation has been completed to the standards indicated by these specifications, arrange for the Engineer to review installation and operation.

3.7 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

.1 The equipment manufacturer's technical representative shall be familiar with the equipment supplied and shall come prepared with both knowledge and equipment to perform and interpret the test, inspections and procedures recommended by the manufacturer for the starting of equipment that has not previously been run.

.2 The equipment manufacturer's technical representative shall, immediately after completion of the inspection, convey to the Engineer in writing, confirmation of the tests and inspections carried out and the result of this examination of the work.

.3 If the inspection reveals defects in the work, correct as soon as possible and repeat the entire inspection procedure. Repeat until the work passes the inspection.

.4 Document the results of the inspection by the equipment manufacturer's representative.

.5 Ensure the installation meets all manufacturer's requirements for durable and trouble-free operation.

3.8 FIELD INSPECTION

.1 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. 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 re-inspected, the cost of the inspection will be borne by the Contractor.

END OF SECTION

1. GENERAL

1.1 REFERENCE

.1 All water retaining or carrying pipes and structures, and all chemical solution components shall be tested for leakage.

.2 Where work is undertaken within existing structures or piping, they shall be pressure tested and disinfected prior to being put back into operation.

.3 All testing and disinfection shall be as specified herein or elsewhere in these specifications or as directed by the Owner's Representative.

.4 The Contractor shall furnish the disinfecting chemicals, 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 pipeline or structure, expelling air, pumping to the required test pressure, and dewatering the line or structure without additional compensation

2. PRODUCTS

2.1 REFERENCE

.1 All materials, equipment, substances, etc. that will come in contact with potable water shall conform to ANSI/NSP standards 60/61 and the manufacturers shall be included on the list of approved manufacturers published by ANSI/NSF

2.2 WATER

.1 All water used for the initial disinfection, hydrostatic and pressure testing shall be supplied by the contractor or can be taken from the existing well source.

.2 The Contractor shall be responsible for the supply and installation of all temporary pipework, pumps, water trucks or other equipment required to transport the water from the point of supply to the structure or piping to be tested.

2.3 CHLORINE

.1 Chlorine used in disinfection will be calcium hypochlorite or sodium hypochlorite to AWWA B300-80.

.2 Disinfection of the domestic and potable water piping will be conducted with the continuous feed method in accordance with AWWA C651 and C653.

3. EXECUTION

3.1 CLEANING

.1 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.

3.2 HYDROSTATIC TESTING OF FIBERGLASS AND OTHER PREFABRICATED RESERVOIRS

.1 An initial hydrostatic test shall be undertaken by the supplier prior to shipping and a certificate supplied to the owner. A second hydrostatic test shall be completed after installation. Test duration shall be for 24 hours.

.2 The Owner's Representative shall be notified at least 48 hours before any testing begins, and the procedures and leak detection method shall be submitted in writing to the Owner's Representative for his approval. Perform test in the presence of Owner's Representative.

.1 If any test shows leakage or if leaks or persistently damp patches are visible, the structure shall be emptied, carefully examined, and all defects repaired by the method outlined elsewhere in these specifications or by other means approved by the Owner's Representative. Such tests shall be repeated until no leak or persistently damp patches are present.

3.3 HYDROSTATIC TESTING OF WATER RETAINING CONCRETE STRUCTURES

.1 Hydrostatic testing shall be carried out only after the structures have been completely constructed and structural concrete has achieved (28-day) design strength, and after disinfection of reservoir has occurred.

.2 Backfilling or damp proofing shall not be started until testing has shown the structures to be watertight.

.3 Prior to commencing the hydrostatic testing of structures, the Contractor shall repair all visible cracks in the walls, roof and floor.

.4 The Owner's Representative shall be notified at least 72 hours before any testing begins, and the procedures and leak detection method shall be submitted in writing to the Owner's Representative for his approval. Perform test in the presence of Owner's Representative.

.1 The Contractor shall ensure that the exterior surface of the water retaining structures which are being hydrostatically tested are maintained at a minimum temperature of 5 °C during the entire testing period. The cost of heating and hoarding (if required) to achieve this minimum testing temperature shall be borne by the Contractor.

.2 Fill the concrete structure to full supply level (which will be designated by a mark scored on the tank wall) at a rate of 600 mm per day and let it stand for 24 hours.

.3 Measure the drop in liquid level over the next 72 hours and determine the average liquid volume loss over 24 hours. Net Liquid loss for a period of 24 hours shall not exceed 0.05% of the concrete structure reservoir volume at the full supply level.

.4 If any test shows leakage or if leaks or persistently damp patches are visible, the structure is to be emptied, carefully examined, and all defects repaired by the method outlined elsewhere in these specifications or by other means approved by the Owner's Representative.

.5 If the leakage exceeds the maximum allowable, the leakage test shall be extended to a total of five days. If at the end of five days the average daily leakage does not exceed the maximum allowable, leakage shall be considered satisfactory. If the average daily leakage still exceeds the maximum allowable, the reservoir leakage shall be considered excessive and the reservoir shall be repaired and re-tested until leakage falls within the appropriate limit.

.6 Upon mutual agreement between the Contractor and the Owner's Representative, the reservoir may be backfilled completely before the leakage test is undertaken. The leakage test is to then be performed as outlined above. The Contractor is responsible for all costs incurred to bring the leakage within the allowable limits, including any excavation and backfilling required to facilitate repairs, if necessary.

3.4 PRESSURE TESTING OF PIPING

.1 Pressure testing shall be conducted on the piping to the pressures and durations as follows (or the maximum rated pressure of the pipeline, whichever is less):

System	Test Pressure, kPa	Duration, h
Pump Distribution Lines and Headers	1575	6
All other Mechanical Piping	1050	6

.2 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.

.3 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied, if necessary.

.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 zero. Repeat hydrostatic test until all defects have been corrected and no loss of water is observed**.**

3.5 DISINFECTION OF STRUCTURES AND PIPING

.1 The Contractor has the choice of two methods for disinfecting the structures. Method (.2) shall be utilized for disinfecting pipework.

.1 All interior surfaces will be disinfected by spraying the swabbing the surfaces with a concentrated chlorine/water solution. The chlorine content of water used for spray disinfection shall be 200 ppm. Areas within the structure which have been repaired or otherwise contaminated subsequent to disinfection shall be disinfected again to the Owner's Representative's satisfaction.

.2 The structures or pipework shall be disinfected during the hydrostatic or pressure testing by adding chlorine or a chlorine compound to the water to produce an initial concentration of at least 25 ppm. This water shall be retained in the structure/pipeline for a minimum period of 24 hours. If repair work is required

following the hydrostatic or pressure testing, the contractor shall disinfect the repaired areas to the Owner's Representative's satisfaction.

.3 At the completion of the leakage and disinfection test, further flushing and filling with potable water shall be undertaken by the Contractor before bacteriological tests are carried out by the owner. Water used for the test shall not be permitted to be used for plant production. The water shall be pumped gradually to the creek. If the chlorine residual is above 5 ppm then it shall be reduced to below 5 ppm before discharge.

.4 Perform bacteriological tests on piping and reservoir, after chlorine solution has been flushed out. Should contamination remain or recur during this period, repeat disinfecting procedure.

.5 Do not put system into service until a certificate stating that the water is free from contamination has been issued by Health Canada or a recognized laboratory.

.6 If there is any indication of contamination, the contractor shall be required to repeat disinfection. This shall be done by the contractor at his expense under the supervision of the Owner's Representative in accordance with AWWA C651 Standard for Disinfecting Water Mains.

3.6 ENTRY INTO EXISTING OR PREVIOUSLY DISINFECTED POTABLE WATER STORAGE STRUCTURES

.1 Where entry is required either into existing potable water retaining structures or piping, or into previously disinfected new structures, the Contractor shall ensure that the following measures are taken.

.1 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 un-disinfected areas.

.2 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.

.3 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 of the affected structures shall be re-disinfected on return.

.4 Disinfection of footwear, tools, equipment and access area shall be by spraying with a 200 ppm concentrated chlorine/water solution.

.5 Workmen who show signs of illness shall not work within the affected structures or surrounding access area.

3.7 INSTRUMENTATION PROTECTION

.1 All instruments that have a maximum range of less than the hydrostatic or pneumatic test pressure noted above shall be removed or isolated during the pressure tests. 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.

3.8 SAFETY RELIEF VALVES

.1 All safety relief valves for water services shall be supplied with test gauges for hydrostatic testing purposed. Upon completion of the hydrostatic testing, the Contractor shall remove the test gags and re-pressure the system to the relieving pressure of the relief valves to ensure that the valves are relieving at their set-point.

3.9 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 the 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 the 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 Owner's Representative, it is necessary.

.4 All pressure testing shall be done in the presence of the Engineer or Owner's representative.

END OF SECTION

1. GENERAL

1.1 INTENT

.1 The work in this section to include, but not necessarily be limited to the following:

.1 Supply, installation, connection and calibration of all instruments as listed in Division 40.

.2 Valves, flow meters and other in-line instruments supplied and connected in this section to be installed in Division 40.

.3 Shipment of instrumentation components to the control and instrument panel manufacturer where applicable.

.4 Supply, installation and connections of all cable, conduit and wiring for the control and instrumentation systems.

.5 Supply, installation and connection of control panels.

.6 Installation and connection of Programmable Logic Controller.

1.2 INSTRUMENT SUB-CONTRACTORS

.1 The work as specified in this Section to be performed by a qualified control and instrumentation sub-contractor.

1.3 SHOP DRAWINGS

.1 Submit the following items:

.1 Field Instruments listed in Division 40.

.2 Uninterruptible Power Supply.

.3 Control Panels.

.4 Control Relays.

.5 Rail-Mount Terminals.

.6 Rail-Mount Fuse Holders

.2 Shop drawings to indicate (where applicable):

.1 Instrument tag numbers(s).

.2 Available range.

.3 Materials of construction.

.4 Wetted materials.

.5 Accuracy.

.6 Rating of enclosure.

.7 Other details listed on the Instrument Specification Sheet

2. PRODUCTS

2.1 CALIBRATION

.1 Prior to start-up, submit to Owner representative calibration sheets for instrument which is adjustable indicating the setpoint(s) and by whom the calibration was performed.

.2 For micro-processor based instruments in which parameters must be entered as part of configuring or calibration, list all the values entered.

.3 List the settings of all DIP-switches, jumpers, etc.

2.2 SPARE PARTS

.1 Provide the following spare parts:

.1 Five bulbs of each type used.

.2 Ten fuses of each type and rating used.

.3 Two control relays of each type used.

.4 Two rail-mount circuit breakers of each type used.

.5 Two push-button and selector switch contact blocks to each type used.

3. EXECUTION

3.1 INSTRUMENT TAGGING

.1 Provide each instrument with a tag stamped or engraved with the Instrument number.

.2 Tags to be brass, stainless steel or laminated plastic.

.3 Affix tags to instruments with stranded stainless steel wire or adhesive. Do not use adhesive on curved surfaces.

3.2 MANUFACTURER'S REPRESENTATIVE

.1 Where indicated, retain the services of the instrument representative to inspect the installation of the instrument and to calibrate and configure it.

3.3 START-UP

.1 Upon completion of work, all circuits are to be operational and all instruments operating within manufacturer's specifications.

.2 Prior to notifying Owner representative to start-up system, check all correctness, verify all PLC inputs, and outputs, and complete Record Drawings as described in this section.

.3 Electrical controls, circuits and systems shall be tested by trial operation of control equipment after all wiring is completed to see that each interlock and control function operates in accordance with the contract drawings and the description of operation for the equipment. Where field conditions prevent actual equipment functioning during testing, the contractor shall simulate the intended operating condition in the associated control circuits.

.4 The contractor shall locate the cause of any malfunction and make the necessary wiring and / or equipment changes or corrections to obtain the particular systems intended operation as defined by the contract drawings. Such changes shall be included in the test report.

.5 Control Panels shall be operated through all design functions. This shall include remote operation of all equipment and actuation of alarms and indicating devices according to design requirements.

.6 Complete operation tests shall be given to all relays, and control devices to show that the equipment performs all design functions and meets design and procurement specifications.

.7 During start-up, assist Owner’s Representative in debugging system operation and correct any deficiencies and omissions which appear.

3.4 RECORD REPORTS

.1 During each of the aforementioned tests, the electrical contractor shall maintain a comprehensive set of test reports defining the specific condition in which the apparatus is left, after it has been given approval for use in its intended service. The completed report shall become the property of the Owner.

.2 A check list type report for each individual item of major electrical equipment should be headed with but not limited to the following identification data, defining:

.1 Equipment Name.

.2 Item Tag Number.

.3 Manufacturer.

.4 Type of Class.

.5 Application.

.6 Plant Location.

.7 Voltage Rating.

.8 Date of Test.

.9 Ambient Conditions.

.10 Testers Signature.

.3 Among the specific requirements of testing to determine the equipment's operation condition relative to that particular apparatus, all items shall be visually inspected and evaluated on the report as to its general condition both exterior and interior.

.4 Unless otherwise directed by Owner's Representative, the forms used for testing shall be those, which are available by the particular equipment's manufacture

END OF SECTION

1. GENERAL

1.1 INTENT

.1 All field instruments required including:

.1 Magnetic Flow Meters

.2 Pressure Gauges

.3 Level Transmitters

.4 Temperature Transmitters

1.2 RELATED SECTIONS

.1 Division 23 – Mechanical, all sections

.2 Division 26 – Electrical, all sections

1.3 UNIFORMITY OF INSTRUMENTS

.1 Instruments of one manufacturer to be used throughout to the extent practical. Variations will be permitted only where the major supplier cannot supply a particular instrument as specified.

.2 Note that where the specifications specify a variety of instrument manufacturers, these are to establish standards of quality.

.3 All instruments must be CSA approved and meet all applicable industry standards and codes.

1.4 DRAWINGS AND DESIGN

.1 The drawings are intended to show the major details of the controls and instrumentation work but it is the Contractor's responsibility to examine the electrical, mechanical, structural and architectural drawings before beginning the work and report to the Owner’s Representative any discrepancies or interferences which may occur.

.2 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 to be governed by the mechanical, structural and architectural conditions which prevail.

.3 The Owner’s Representative reserves the right to change the location of any piece of equipment without extra payment therefore, providing only that the change is requested before installation and that the new location is within 1.5 meters of the original location.

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings.

.2 Indicate:

.1 Instrument manufacturer's name, type, model, year, and serial number.

.2 The manufacturer's specifications for each instrument.

.3 Outline and arrangement drawings.

.4 Cross-sectional drawings.

.5 Materials of construction.

.6 Available range and accuracy.

.7 All other pertinent product information and data.

1.6 OPERATION & MAINTENANCE DATA

.1 Provide operating & maintenance data for incorporation into the Operation and Maintenance Manual.

.2 Data to Include:

.1 Manufacturer's name, type, model year, capacity and serial number.

.2 Details on operation, servicing and maintenance.

.3 As-built wiring diagrams.

.4 Available range, accuracy and rating information of instrument.

2. PRODUCTS

2.1 GENERAL

.1 Manufacturer and Supplier:

.1 All instruments shall be of a manufacturer/supplier with service facilities in British Columbia.

.2 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 a substantial steel or brass nameplate attached to the unit, clearly inscribed with the manufacturer's name, year of manufacture and the principal rating data.

.3 Painting:

.1 Paint all equipment where applicable to appropriate sections in Division 09.

.4 Instrument Description:

.1 All instruments are given a description "Tag #". The Tag # refers to the description relative to the P & I drawings and mechanical drawings for reference.

2.2 MAGNETIC FLOW METERS

.1 General

.1 All meters within this subsection shall be provided by the same manufacturer.

.2 Applicable Equipment: FIT 122

.3 Liquid Type: Raw Water

.4 Size: 50 mm

.5 Location: FIT 122: Well Kiosk

.6 Acceptable Supplier:

.1 ABB

.7 Operating Conditions:

.1 Temperature: 1 – 25 °C.

.2 Maximum Flow Rate:

.1 FIT 122: 4 L/s

.8 Specified materials:

.1 Pressure Rating: 690 kPa

.2 Body Material: Carbon Steel

.3 Mounting: ANSI 125 Flange

.4 Liner material: Polyurethane

.5 Electrode: 316 Stainless Steel

.6 Grounding: required

.9 Transmitter:

.1 Output: 4 – 20 mA

.2 Power: 120 VAC

.3 Accuracy: 1% of full span

.4 Mounting: Integral

.5 Output meter scale: LCD

.6 Calibration Range:

.1 FIT 122: 0 to 4 L/s.

.7 Flow Rate Units: L/s

.8 Totalizer Location: Integral

.9 Totalizer Units: m^3

2.3 PRESSURE GAUGES

.1 Applicable Equipment: All pressure gauges

.1 Liquid Type:

.1 All pressure gauges: Raw Water

.2 Location: Well Kiosk

.3 Minimum Required Pressure Range: 0-150 psi

.4 Specified Equipment:

.1 Manufacturer: Ashcroft.

.2 Model: 45-1279 AS-4L.

.3 Type: 115 mm solid front black phenol turret case with blowout back, +/- ½% full scale accuracy, stainless steel rotary gear movement, grade A phosphorous bronze boudon tube, and adjustable micrometer pointer. Liquid silicone filled suitable for temperature range –45°C to 65°C.

.4 Connections: 12 mm M.N.P.T. lower connection.

.5 Accessories: All connections as required.

2.4 HYDROSTATIC PRESSURE TRANSMITTERS

.1 Applicable Equipment: LT 112

.1 Liquid Type: Raw Water

.2 Location: Production Well

.3 Mounting:

.1 As per manufacturer's recommendation or as indicated on drawings

.4 Specified Equipment:

.1 Manufacturer: PMC or approved equivalent

.2 Type: Submersible hydrostatic gauge pressure

.3 Housing Material: 316L Stainless Steel

.4 Nose Cone Diameter: 25mm (1")

.5 Cable: Polyurethane Jacket

.6 Power: Loop powered 2-wire 24VDC

.7 Output: 4-20 mA

.8 Accuracy: 0.1% FS

.9 Calibrated Range: 0-7,000mm (0-10psig)

.10 Cable length: as required to reach junction box

.11 Accessories:

1. Reference Volume MP11

2.5 TEMPERATURE TRANSMITTERS

.1 Tag#: TT 191, 190

.2 Equipment: RTD Transmitter.

.3 Locations: Well Kiosk

.4 Specified Equipment:

.1 Supplier: Endress and Hauser

.2 Model: TST434-J1A3DW

.3 Type: Wall mount NEMA 4

.4 Electrical connection: 1/2”NPT

.5 Output: 4-20mADC

3. EXECUTION

3.1 INSTALLATION

.1 The Contractor to be responsible for the correct installation and assemble of all items of equipment. Manufacturer's instructions to be carefully read and rigidly adhered to in the installation.

.2 Any damage resulting from failure to observe the installation instruction or as a result of proceeding without sufficient knowledge of proper installations techniques will be the Contractor's responsibility.

.3 Mounting of Instruments & Accessories:

.1 Instruments to be installed in accordance with the drawings. Instruments shall be 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 not to be installed until heavy construction work adjacent to the instruments has been completed.

.3 Instruments devices, including accessories, to be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments to face toward and within reading distance of a normal operating area.

.4 Sufficient clearance to be allowed for removal of equipment for maintenance and repair.

.5 Field located instruments to be mounted on building columns and walls or pipe stands and/or other means of support as required in accordance with manufacturer's instructions and the Contract Drawings.

3.2 TESTING, ADJUSTING AND COMMISSIONING

.1 Testing, adjusting and commissioning of all instruments shall be in accordance with Section 40 90 00.

END OF SECTION

1. GENERAL

.1 Not Applicable.

2. PRODUCTS

2.1 PROGRAMMABLE LOGIC CONTROLLERS

.1 Provide PLC and miscellaneous equipment as per PLC drawings.

3. EXECUTION

3.1 INSTALLATION

.1 Contractor is responsible for installation, wiring, testing, and assisting the Owner's Representative in commissioning of all PLC equipment, HMIs and communication equipment.

.2 Contractor shall supply and deliver to the Owner's Representative any of the products identified herein for the purpose of programming. The Owner's Representative will advise the contractor when and which items will be required on a later date. The contractor will pay all costs associated with handling, extended warranties, etc.

.3 The Contractor to be responsible for the correct installation and assemble of all items of equipment. Manufacturer's instructions to be carefully read and rigidly adhered to in the installation.

.4 Provide weather proof installation for all exterior installation.

.5 The contractor shall supply and install all materials for a complete and operational system.

3.2 PROGRAMMING

.1 By owner.

END OF SECTION

1. GENERAL

.1 Not Applicable.

2. PRODUCTS

2.1 CONSTRUCTION

.1 As per Control Panel Bill of Materials.

2.2 TERMINALS

.1 As per Control Panel Bill of Materials.

2.3 LABELING

.1 Each terminal to be labeled with snap on plastic tags, as per Control cabinet's bill of Materials, machine-printed.

.2 All panel-mounted devices to be labelled by means of engraved lamacoid labels, white lettering on black.

.3 Write on labels are not acceptable.

2.4 CONTROL RELAYS

.1 Control relays to be rail mounted, with built-in LED or neon operation indicator, varistor protection, coil voltage as required, CSA approved.

.2 Contacts to switch 10A 120/240V AC inductive or resistive.

.3 Operating times to be 20 mS max for AC coil, 30 mS max for DC coil.

.4 Life expectancy to be 100 000 operations @ 10A 120/240V AC.

.5 Relays to be Phoenix Contact.

2.5 TIME-DELAY RELAYS

.1 Time-delay relays to be installed in socket, with manually-adjustable timing via knob with dial, output status light, operating voltage as required, ON-delay or OFF-delay time as indicated, CSA approved.

.2 Contacts to switch 5A 120/240V AC inductive or resistive.

.3 Life expectancy to be 100 000 operations @ 2A 120/240V AC.

.4 All relays to be OMRON type H3BH, H3G, H3CA, or H3CR or approved alternative.

2.6 PILOT LIGHTS

.1 Water and dust-proof with internal Gasket, jeweled lens, color as shown on drawings, bulb voltage 120VAC.

.2 Lights to be the following:

.1 Allen-Bradley 800T LED ‘push to test’ model.

2.7 PUSH BUTTONS

.1 Water and dust-proof with internal Gasket, flush head, contacts rated 5A 20/240 VAC, accepting AWG 18-12 wires, removable contact blocs.

.2 Push buttons to be the following:

.1 Allen-Bradley 800T.

2.8 SELECTOR SWITCHES

.1 Manual selector switches to be Water and dust-proof with internal Gasket, standard black lever actuator, Maintained position unless indicated, contacts rated 5A 120/240 VAC, accepting AWG 18-12 wires, removable contact blocks.

.2 Selector switches to be one of following:

.1 Allen-Bradley 800T.

2.9 WIRE DUCTS

.1 Use Panduit or equivalent plastic type.

.2 Wiring not installed in wire ducts are to be neatly bundled and secured with wrap around spiral banding, secured with cable ties and mounting bases.

2.10 POWER SUPPLY 24VDC

.1 As per Control Panel Bill of Materials.

END OF SECTION

1. GENERAL

.1 Not Applicable.

2. PRODUCTS

2.1 WIRE AND CABLE

.1 Wire for 120 VAC control signals to be as specified in Division 26, except that control wiring within cabinets shall be AWG 16 stranded copper.

.2 Colour code all control wires as follows:

120VAC Hot	Black
120VAC Neutral	White
24VAC Hot	Brown
24VAC Neutral	White
24VDC Positive	Red
24VDC Negative	Blue
12VDC Positive	Orange
12VDC Negative	Yellow
GROUND	Green

.3 Wire for 24 VDC analog instrument signals to be stranded copper, AWG 18, twisted pair, individual or overall foil shield, 300V rating.

3. EXECUTION

3.1 TERMINATION OF CONDUCTORS

.1 Where spares conductors are pulled into an instrument, junction box or control panel the conductors shall be left long enough to reach anywhere within the enclosure. The spare conductors shall be labeled with cable destination and tied back.

3.2 CABLE LABELING

.1 Label each cable where it enters a panel or instrument with machine-printed heat shrink tag.

.2 Write on labels are not acceptable.

3.3 CONDUCTOR LABELING

.1 Conductors to be labeled at each end by slip-on plastic tags Wieland type Z5 or Weidmuller type Z or by machine-printed heat-shrink labels.

.2 Write-on labels and wrap around machine-printed labels are not acceptable.

3.4 CONTROL CABLE SHIELD TREATMENT

.1 Where drain wire is to be isolated, trim foil and drain wire flush with jacket and apply minimum 20 mm opaque heat shrink centered over the end of jacket.

.2 Where drain wire is to be terminated, trim foil flush with jacket. Apply transparent heat shrink over exposed length of drain wire. Apply minimum 20 mm opaque heat shrink centered over end of jacket/foil.

.3 Where shield drains are grounded at the control panel then these are to be commoned together on an isolated instrument ground with a single connection to the electrical safety ground.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

.1 Division 40 – Process Integration, all sections.

.2 Division 26 – Electrical, all sections.

1.2 UNIFORMITY OF EQUIPMENT

.1 All UV disinfection reactors and related equipment to be from the same manufacturer.

1.3 DRAWINGS AND DESIGN

.1 The drawings are intended to show the major details of the controls and instrumentation work but it is the Contractor's responsibility to examine the electrical, mechanical, structural and architectural drawings before beginning the work and report to the Engineer any discrepancies or interferences which may occur.

.2 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 to be governed by the mechanical, structural and architectural conditions which prevail.

.3 The Engineer reserves the right to change the location of any piece of equipment without extra payment therefore, providing only that the change is requested before installation and that the new location is within 1.5 meters of the original location.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings.

.2 Indicate:

.1 Instrument manufacturer's name, type, model, year, and serial number.
.2 The manufacturer's specifications for each piece of equipment.
.3 Outline and arrangement drawings.
.4 Cross-sectional drawings.
.5 Materials of construction.
.6 Available range and accuracy.
.7 Electrical and control schematic.
.8 Control philosophy.
.9 Product certification.
.10 All other pertinent product information and data.

1.5 OPERATION & MAINTENANCE DATA

.1 Provide operating & maintenance data for incorporation into the - Operation and Maintenance Manual.

.2 Data to Include:

.1 Manufacturer's name, type, model year, capacity and serial number.
.2 Details on operation, servicing and maintenance.
.3 As-built wiring diagrams.
.4 Available range, accuracy and rating information of instrument.

1.6 EQUIPMENT IDENTIFICATION

.1 Tagging:

.1 Provide each pump with a tag stamped or engraved with the equipment number.

.2 Tags to be 20mm high, 75mm long, and 1.5mm thick, plastic Romark "Ultra Suede", 8mm high alphanumeric characters, Helvetica font (01040 cutter), reverse engraved. Characters to be white on coloured background. Background colour to be red.

.3 The code lettering and number system shall be as shown on the P & I drawings or as directed by the Engineer.

.4 Affix tags to equipment securely.

2. PRODUCTS

2.1 GENERAL

.1 Manufacturer and Supplier:

.1 All instruments shall be of a manufacturer/supplier with service facilities on Vancouver Island, British Columbia.

.2 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 a substantial steel or brass nameplate attached to the unit, clearly inscribed with the manufacturer's name, year of manufacture and the principal rating data.

.3 Painting:

.1 N/A.

.4 Instrument Isolation Valves:

.1 Where needed to isolate equipment, provide instruments with block valves, block and bleed valves, or 3-valve manifolds at the discretion of the Engineer.

.2 Use 316 stainless steel valves on stainless steel and carbon steel piping, bronze body valves on copper piping, and PVC ball valves on PVC piping.

.3 Acceptable Material:

.1 Century CM2 block valve (316 SS)
.2 Century CM29 block and bleed valve (316SS)
.3 Chemline model OMP (PVC)
.4 Century CM3 (3-valve 316 SS)
.5 Crane 9302 (Bronze)

.5 Instrument Description:

.1 All instruments are given a description "Tag #". The Tag # refers to the description relative to the P & I drawings and mechanical drawings for reference.

2.2 ULTRA VIOLET DISINFECTION SYSTEM

Applicable Equipment: UV 211, UV 212

.1 Liquid Type: Raw Water

.2 Location: Well Kiosk

.3 Acceptable Supplier: Trojan Technologies Inc.

.4 Operating Conditions:

.1 Temperature: 1 to 25ºC
.2 Maximum Flow Rate: 180 L/min (3 L/s) per reactor.
.3 Ultraviolet Transmittance:
.1 80% minimum for the max design flow of 3 L/s per reactor.
.2 Required UV Dosage to achieve Giardia/Cryptosporidium 3.0 log credit: 40.00 mJ/cm^2

.5 Specified Equipment:

.1 Trojan Technologies Inc., Model: TrojanUVSwift SC B04
.2 Validation: Full compliance with USEPA UV Guidance Manual
.3 Reactor material: SS316L
.4 Number of lamps per reactor: three low pressure high output amalgam lamps
.5 Number of intensity sensors per reactor: one
.6 Total headloss per reactor: 0.03 m w/c.
.7 Flanges: 6” (150 mm), ANSI 150 lb
.8 Automatic Wiping System
.9 Contact: RamTech Environmental Products Ltd., (587) 436-7781.

.6 Electrical:

.1 Each UV reactor will be powered from Electrical Control Panel by means of a waterproof cable interfacing with a watertight strain relief supplied by the UV Manufacturer.
.2 The Control Panel will be of mild steel construction and powder epoxy coated.
.3 Control Panel electrical rating will be a minimum of NEMA 12.
.4 Electrical supply to each control panel shall be 208 V, single phase, 2 wire plus ground, operating power 690w per chamber; connected electrical load 900w per chamber.
.5 Each control panel will have lamicoid identification “UV211, UV212”.

.7 Control and Instrumentation:

.1 System Control:

.1 One microprocessor-based controller will be provided per reactor. Microprocessor to be located within a Control Panel with an operator interface display and is to be located indoors.

.2 Operator interface: Standard

.3 Ethernet/IP communication

.2 Alarm Conditions and Interface:

.1 Remote alarms’ view and acknowledgement shall be accessible to the WTP SCADA and shall be provided by system supplier.

.8 Wiping System:

.1 Trojan ActiClean

3. EXECUTION

3.1 INSTALLATION

.1 The Contractor to be responsible for the correct installation and assembly of all items of equipment. Manufacturer's instructions to be carefully read and rigidly adhered to in the installation.

.2 Any damage resulting from failure to observe the installation instruction or as a result of proceeding without sufficient knowledge of proper installations techniques will be the Contractor's responsibility.

.3 The Contractor shall be responsible for installation and support of the UV reactors within the process piping. The UV reactors shall be installed such that it remains full of water at all times. Installation of the UV reactors is to be in the horizontal position with the outlet flange oriented at 12 o’clock.

.4 Bolting and gasketing required for installation and mounting are the responsibility of the contractor. Associated equipment such as isolation and drain valves is the responsibility of the contractor.

.5 Mounting of Instruments & Accessories:

.1 Instruments to be installed in accordance with the drawings. Instruments shall be 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 not to be installed until heavy construction work adjacent to the instruments has been completed.

.3 Instruments devices including accessories to be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments to face toward, and within reading distance of a normal operating area.

.4 Sufficient clearance to be allowed for removal of equipment for maintenance and repair.

.5 Field located instruments to be mounted on building columns and walls or pipe stands and/or other means of support as required in accordance with manufacturer's instructions and the Drawings.

3.2 INSPECTION

.1 The Contractor will include in Bid any costs for inspection and startup services by a qualified factory trained manufacturer’s representative to inspect and certify the completed installation of the field instrument.

.2 The Contractor will, after obtaining confirmation from the Engineer, arrange for the equipment supplier’s inspection and will provide sufficient personnel and materials to assist the manufacturer in the inspection, testing and commissioning of each system completely.

.3 The Contractor will obtain from the manufacturer written certification of the complete installation and testing and will forward to the Engineer.

.4 The Contractor will, at their own expense, repair any irregularities or discrepancies determined during the examination. Any additional trips required by the manufacturer’s representative for re-testing due to faulty installation or broken equipment shall be borne by the Contractor.

3.3 TRAINING

.1 The Contractor will include in their price costs a minimum of one day of training for the operating personnel for the UV disinfection system operation by a qualified manufacturer personnel. The training shall cover all aspects of operation, maintenance and calibration of the UV disinfection equipment.

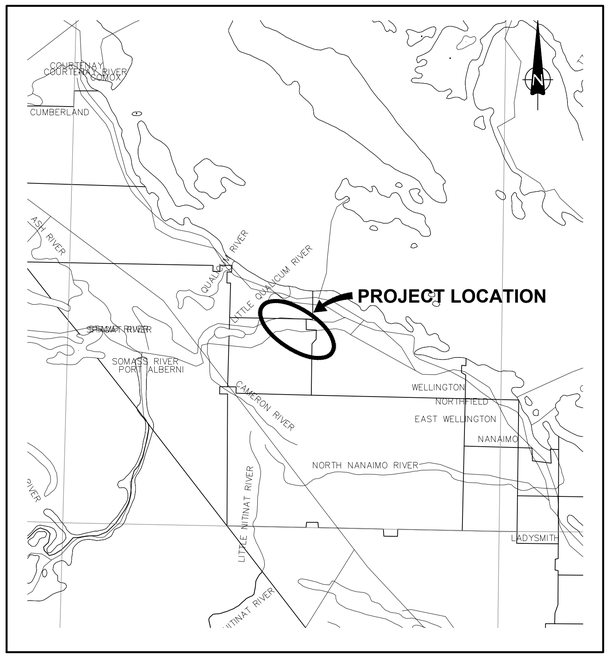
3.4 TESTING, ADJUSTING AND COMMISSIONING

.1 Testing, adjusting and commissioning of all equipment and instruments shall be in accordance with the manufacturer's requirements.

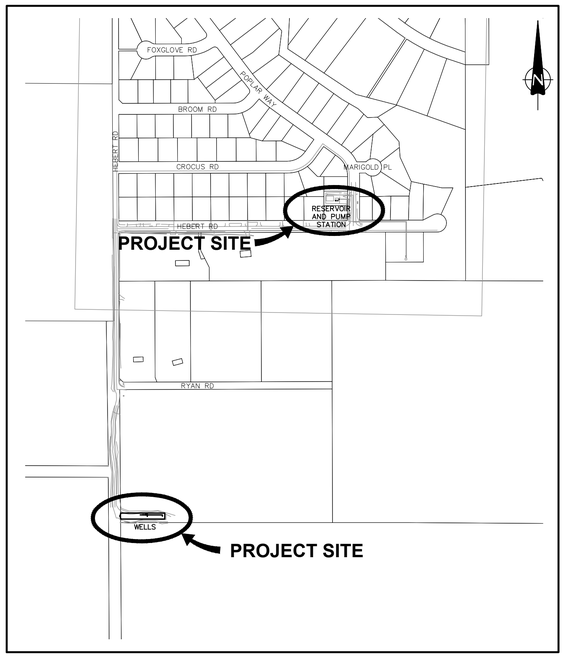
.2 The contractor shall bear the cost of UV equipment system manufacturer representative for the period of time required for commissioning of the UV system.

END OF SECTION

SET _____



LOCATION PLAN



SITE PLAN

REGIONAL DISTRICT OF NANAIMO
WHISKEY CREEK PRODUCTION WELL SITE
PHASE 1A
FOR TENDER
9794-003-00

MPE Engineering Ltd.

LIST OF DRAWINGS PHASE 1A:

GENERAL:

--	TITLE PAGE
G00.1	LIST OF DRAWINGS

CIVIL:

C13.1	WELL SITE PLAN

STRUCTURAL:

S11.1	WELL KIOSK CONCRETE PAD

PROCESS:

P00.1	INSTRUMENTATION LEGEND
P12.1	PROCESS & INSTRUMENTATION DIAGRAM WELL SITE
P12.2	PROCESS & INSTRUMENTATION DIAGRAM WELL SITE AUXILIARIES
P22.1	PROCESS & INSTRUMENTATION DIAGRAM RESERVOIR AND PUMP STATION
P13.1	WELL KIOSK LAYOUT
P13.2	WELL KIOSK SECTION
P14.1	WELL DETAILS
P15.1	MISCELLANEOUS DETAILS

MECHANICAL:

M11.1	WELL KIOSK MECHANICAL LAYOUT

ELECTRICAL:

E00.1	LEGEND
E00.2	INSTRUMENT WIRING TYPICALS
E11.1	WELL SITE PLAN
E11.2	WELL KIOSK FLOOR PLAN
E11.3	WELL KIOSK SECTION
E11.4	WELL KIOSK SECTION
E11.5	UNDERGROUND CABLE DETAILS
E11.6	WELL DETAILS
E12.1	WELLS SINGLE LINE DIAGRAM
E12.2	WELLS PANEL SCHEDULE
E12.3	WELLS TYPICAL VFD MOTOR CONTROL
E12.4	WELLS CABLE SCHEDULE
E13.1	WELLS CONTROL ARCHITECTURE
E13.2	WELLS CONTROL PANEL LAYOUT
E13.3	WELLS CONTROL PANEL BILL OF MATERIALS & LABEL SCHEDULE
E13.4	WELLS CONTROL PANEL TERMINAL STRIP LAYOUT
E13.5	WELLS CONTROL PANEL POWER DISTRIBUTION
E13.6	WELLS SIGNAL WIRING DIAGRAM
E13.11	WELLS PLC ANALOG INPUT /OUTPUT MODULES
E13.12	WELLS PLC DIGITAL INPUT MODULES 1 AND 2
E13.13	WELLS PLC DIGITAL OUTPUT MODULE 1
E21.1	RESERVOIR AND PUMP STATION SITE PLAN
E21.2	PUMP STATION EQUIPMENT LAYOUT
E22.1	PUMP STATION SINGLE LINE DIAGRAM
E22.4	PUMP STATION CABLE SCHEDULE
E23.1	PUMP STATION CONTROL ARCHITECTURE
E23.2	PUMP STATION CONTROL PANEL LAYOUT
E23.3	PUMP STATION CONTROL PANEL BILL OF MATERIALS & LABEL SCHEDULE
E23.4	PUMP STATION CONTROL PANEL TERMINAL STRIP LAYOUT
E23.5	PUMP STATION CONTROL PANEL POWER DISTRIBUTION
E23.11	PUMP STATION PLC ANALOG INPUT MODULE 1
E23.13	PUMP STATION PLC DIGITAL INPUT MODULE 1

NOTES:

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

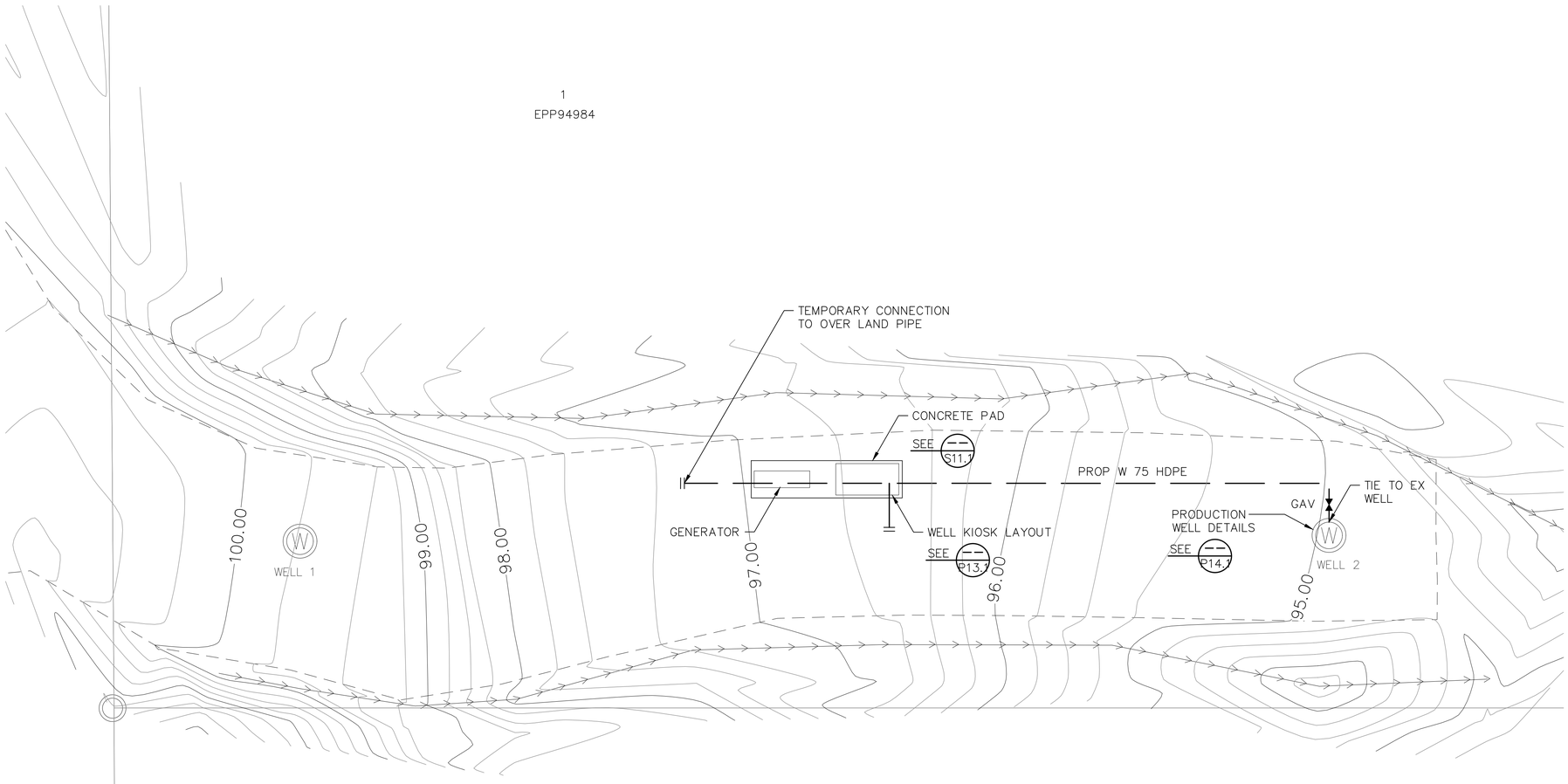
MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
GENERAL
LIST OF DRAWINGS

DESIGNED	J.M.H.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	G00.1

1
EPP94984



4
VIP2002

PROPOSED	LEGEND	EXISTING
	DRAINAGE DITCH	
	FENCE	X
	EDGE OF PAVEMENT	
	EDGE OF GRAVEL	
	BURIED POWER	
	MAILBOX	
	POWER POLE	PP
	CULVERT	
	WATER WELL	
	STANDPIPE	
PROP W 75 HDPE	WATER MAIN	EX W CL 150 AC
	WATER VALVE	
	WATER HYDRANT	

NOTES:
1. ALL PIPE SIZES ARE IN MILLIMETRES AND ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL BOLD ITEMS INDICATE WORK TO BE DONE AND ALL LIGHT ITEMS INDICATE EXISTING CONDITIONS.
3. SLOPE AS PER OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

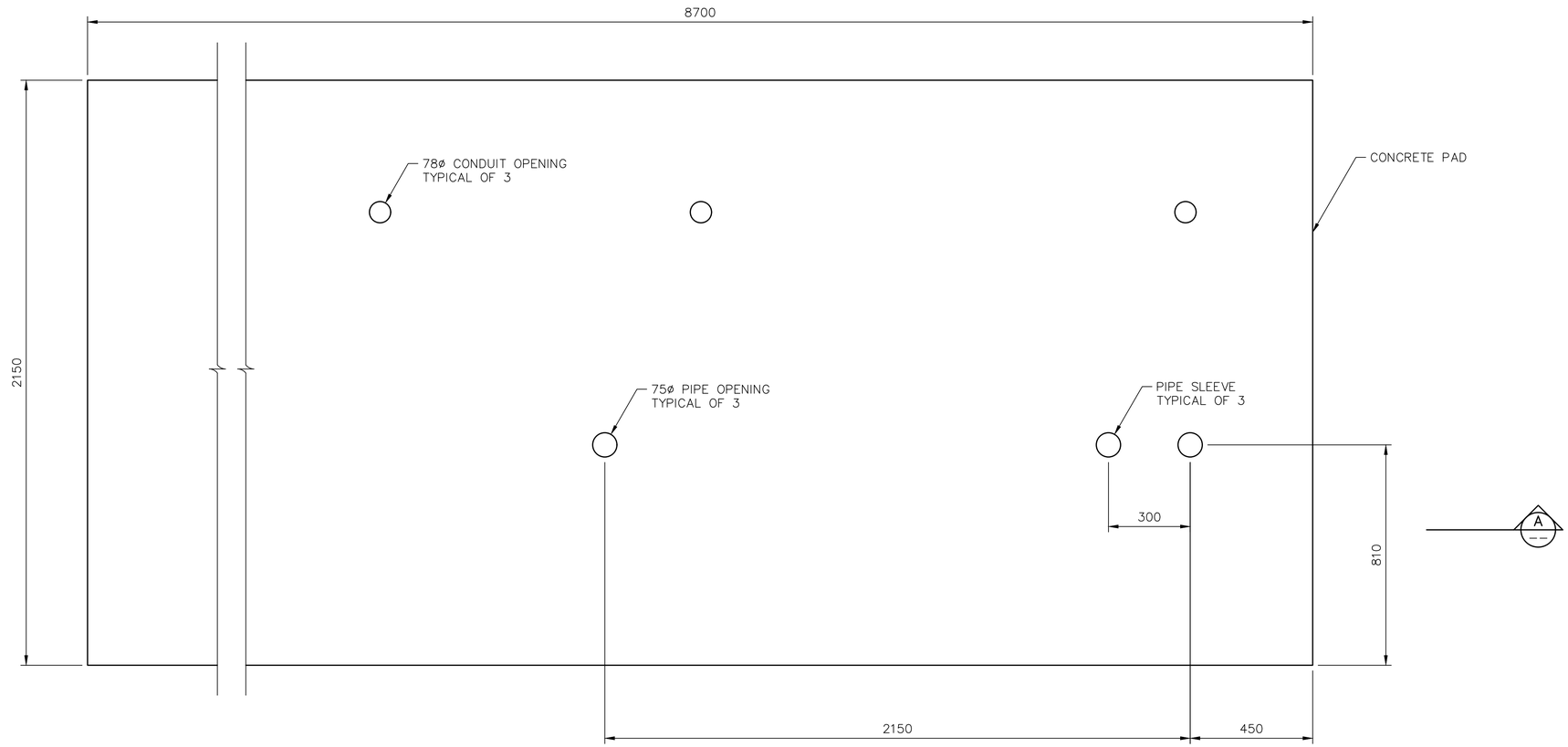
Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

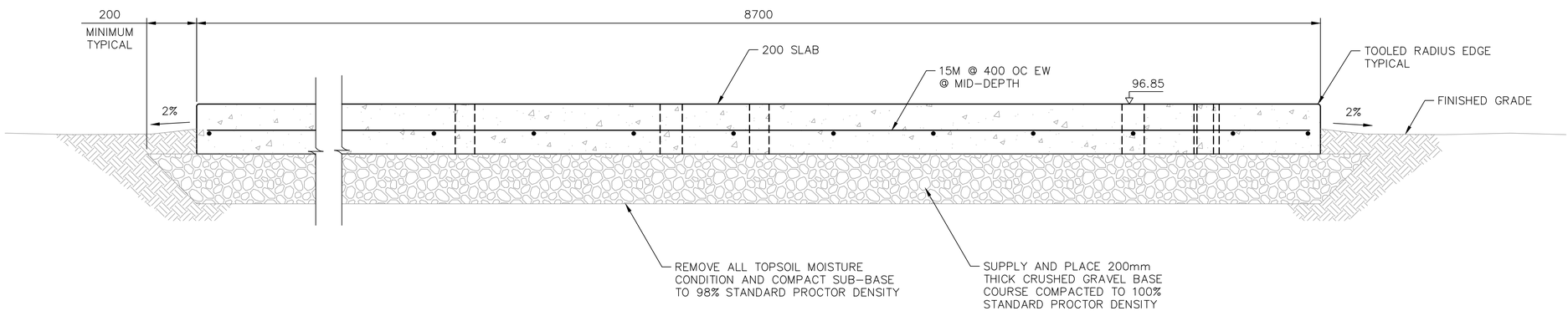
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
CIVIL
WELL SITE PLAN

DESIGNED	J.M.H.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:150
DATE	JANUARY 2021	DRAWING	C13.1



PLAN



NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. CONTRACTOR TO FIELD CONFIRM PENETRATION LOCATIONS.
3. WELL KIOSK TO BE ANCHORED TO CONCRETE PAD AS PER MANUFACTURERS RECOMMENDATIONS.
4. EMBEDDED CONDUITS TO BE INSTALLED AS PER ELECTRICAL LAYOUT DRAWINGS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
C. J. FORSYTH
51135
22 January 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
STRUCTURAL
WELL KIOSK CONCRETE PAD

DESIGNED	C.J.F.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	S11.1

IDENTIFICATION LETTERS

	FIRST–LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	INPUT/OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		AUTO
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	COMMUNICATION			CONTROL	CLOSE
D	USER'S CHOICE	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			FAULT
G	USER'S CHOICE		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOTOR	MOMENTARY			MIDDLE INTERMEDIATE
N	SECURITY		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY OR EVENT	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		RUN/REMOTE
S	SPEED, FREQUENCY	SAFETY		SWITCH/STATUS	STOP
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

INSTRUMENT/DEVICE IDENTIFICATION EXAMPLES (aaa)



AIT	ANALYZER INDICATOR TRANSMITTER
FCV	FLOW CONTROL VALVE
FIT	FLOW INDICATOR TRANSMITTER
LIT	LEVEL INDICATOR TRANSMITTER
PCV	PRESSURE CONTROL VALVE
PIT	PRESSURE INDICATOR TRANSMITTER
PI	PRESSURE INDICATOR (PRESSURE GAGE)
TSH	TEMPERATURE SWITCH HIGH (HEAT DETECTOR)
TSL	TEMPERATURE SWITCH LOW (HEAT DETECTOR)
ZSC	POSITION SWITCH CLOSE (DOOR CONTACT)

MOTOR FUNCTION EXAMPLES (aaa)



HSA or HA	HAND STATUS AUTO (AUTO SIGNAL FROM THE HAND–OFF–AUTO SWITCH) – DI
MCR or YS	MOTOR CONTROL RUN (START) – DO
MSR or YC	MOTOR STATUS RUN – DI
MSF or YA	MOTOR STATUS FAULT (OVERLOAD) – DI
SY or SC	SPEED COMPUTE/CONVERT (CONTROL) – AO
ST or SI	SPEED TRANSMIT (FEEDBACK) – AI
TSH or YA	TEMPERATURE STATUS HIGH (THERMISTOR) – DI
LSH or YA	LEVEL STATUS HIGH (LEAKAGE IN SUBMERSIBLE PUMP SEAL) – DI

VALVE FUNCTION EXAMPLES (aaa)



ZY or ZC	POSITION COMPUTE/CONVERT (CONTROL) – AO
ZT or ZI	POSITION TRANSMIT (FEEDBACK) – AI
ZCO or YSO	POSITION CONTROL OPEN – DO
ZCC or YSC	POSITION CONTROL CLOSE – DO
ZSO	POSITION STATUS OPEN – DI
ZSC	POSITION STATUS CLOSE – DI

EQUIPMENT TAG

LOCALLY MOUNTED INSTRUMENT

PANEL MOUNTED INSTRUMENT

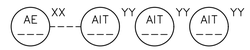
BACK OF PANEL MOUNTED INSTRUMENT

PRESSURE CONTROL VALVE LEGEND (XX)

PCV XX — PRESSURE CONTROL VALVE

SU	SUSTAINING
RD	REDUCING
RL	RELIEVING
SA	SURGE ANTICIPATING
VR	VACUUM RELIEF

ANALYZING ELEMENT/ALARM LEGEND (YY)



PROCESS ANALYZER

CL2	CHLORINE
TURB	TURBIDITY
pH	pH
DO	DISSOLVED OXYGEN
CON	CONDUCTIVITY
TEMP	TEMPERATURE
PC	PARTICLE COUNT

BUILDING ANALYZING ELEMENT/ALARM LEGEND



BUILDING ANALYZER

Y

H	HIGH
L	LOW
F	FAULT

ZZ

SMK	SMOKE
H_2S	H_2S
CH_4	METHANE
CO	CARBON MONOXIDE

FUNCTION BLOCK



XX

AI	ANALOG INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT

Y

H	HART
D	DEVICE NET
C	CONTROL NET
M	MODBUS
P	PROFIBUS
E	ETHERNET

qq — PLC IDENTIFIER

INTERLOCK

X – INTERLOCK NUMBER (IF APPLICABLE)
$ – INTERLOCK SYSTEM (IE; PLC, DCS, MCC, VFD, ETC.)

* – PACKAGE CONTROL INTERFACE
$ – CONTROL SYSTEM TYPE

F — FIRE SYSTEM

S — SECURITY MONITORING SYSTEM

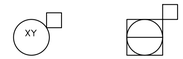
POWER SUPPLY AND PURGE FLUIDS LEGEND

AS	AIR SUPPLY	HS	HYDRAULIC SUPPLY
IS	INSTRUMENT AIR SUPPLY	NS	NITROGEN SUPPLY
PS	PLANT AIR SUPPLY	SS	STEAM SUPPLY
ES	ELECTRICAL SUPPLY	WS	WATER SUPPLY
GS	GAS SUPPLY		

LINE TYPES

- PNEUMATIC SIGNAL
- ELECTRICAL SIGNAL
- HYDRAULIC SIGNAL
- CAPILLARY TUBING (FILLED SYSTEM)
- ELECTRO MAGNETIC OR SONIC SIGNAL (GUIDED).
- ELECTRO MAGNETIC OR SONIC SIGNAL (NOT GUIDED).
- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- MECHANICAL LINK

FUNCTION SYMBOLS



K	PROPORTIONAL	I/P	CURRENT TO PNEUMATIC CONVERTER
√	SQUARE ROOT EXTRACTOR	P/I	PNEUMATIC TO CURRENT TRANSDUCER
>	HIGH SELECTOR	A/D	ANALOG TO DIGITAL
<	LOW SELECTOR	E/P	VOLT TO PNEUMATIC TRANSDUCER
÷	DIVIDE	E/I	VOLT TO CURRENT TRANSDUCER
X	MULTIPLY	MV/I	MILLIVOLT TO CURRENT TRANSDUCER
Σ	SUMMATION	I/I	CURRENT TO CURRENT TR
Δ	DIFFERENCE	f(x)	NON–LINEAR OR UNSPECIFIED FUNCTION
±	BIAS	f(t)	FUNCTION OF TIME
X^n	EXPONENTIAL	REV	REVERSE
⊣	HIGH LIMITING	A/M	AUTO MANUAL
∫	INTEGRAL	AVG	AVERAGE
d/dt	DERIVATIVE		

NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL ITEMS SHOWN IN BOLD INDICATE WORK TO BE DONE. ALL ITEMS SHOWN IN LIGHT INDICATE EXISTING CONDITIONS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY–MM–DD	REVISION
1	21–01–22	FOR TENDER

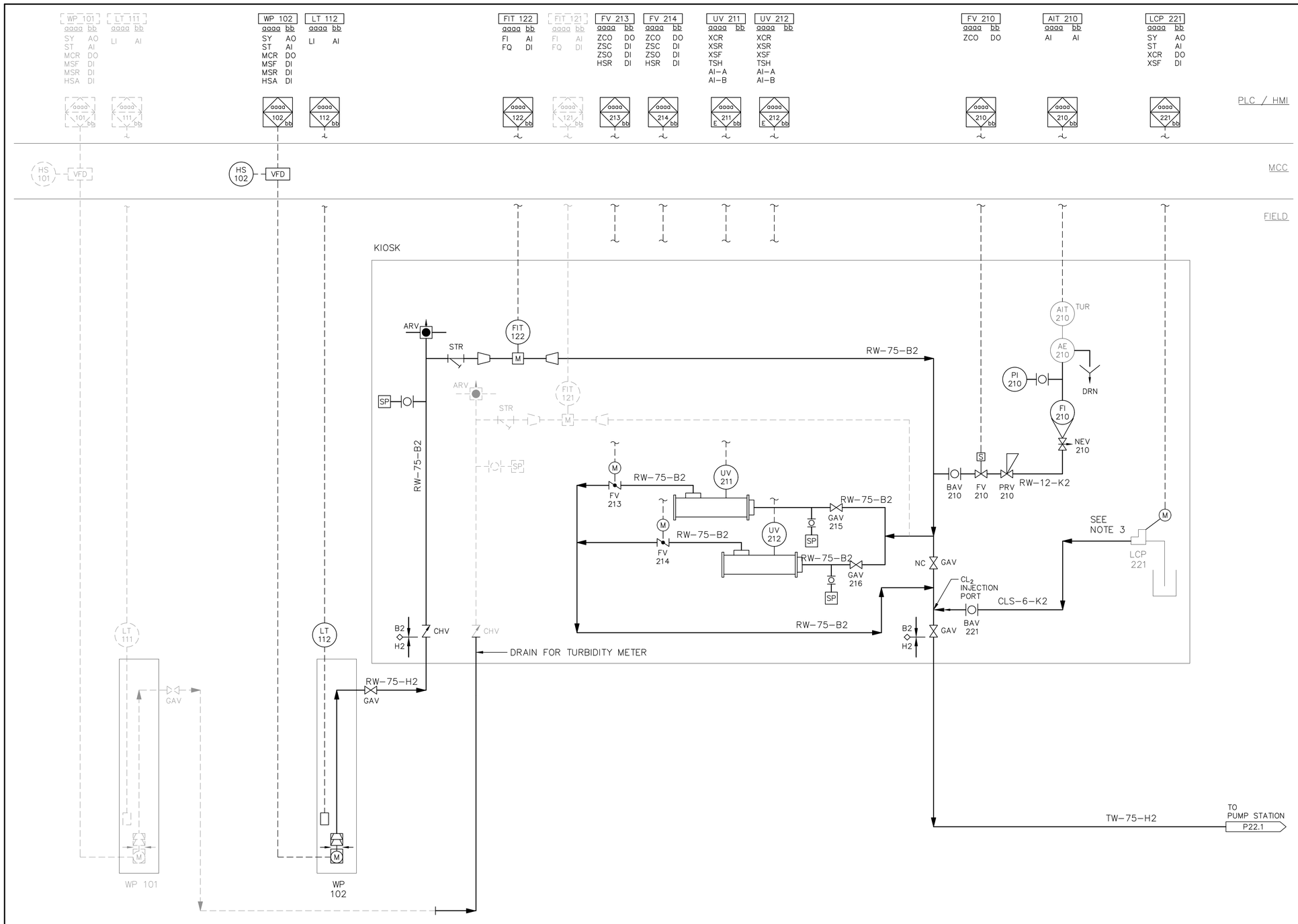
Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A PROCESS INSTRUMENTATION LEGEND

DESIGNED	J.M.H.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	P00.1



NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL ITEMS SHOWN IN BOLD INDICATE WORK TO BE DONE. ALL ITEMS SHOWN IN LIGHT INDICATE EXISTING CONDITIONS. ALL ITEMS SHOWN IN LIGHT/DASHED INDICATE FUTURE WORK AND EQUIPMENT.
3. CHLORINE PUMP TO BE SUPPLIED BY OWNER.
4. TURBIDITY METER TO BE RELOCATED FROM SURFACE WATER PUMP STATION.

EQUIPMENT LEGEND:

- METERING PUMP
- SUBMERSIBLE TURBINE PUMP
- GATE (GAV)
- BUTTERFLY (BUV)
- BALL (BAV)
- NEEDLE (NEV)
- CHECK (CHV)
- SOLENOID
- NORMALLY CLOSED (NC)
- ROTAMETER TYPE FLOW INDICATOR
- DIRECT ACTING PRESSURE CONTROL VALVE (FLAG IN DIRECTION OF CONTROLLED PRESSURE)
- AIR RELEASE (ARV)
- STRAINER "Y" TYPE
- MAGNETIC FLOW METER
- ULTRASONIC OR RADAR LEVEL INSTRUMENT
- SAMPLE POINT (SP)
- ELECTRIC MOTOR

LINE IDENTIFICATION:
RW: RAW WATER
TW: TREATED WATER
CLS: CHLORINE SOLUTION

PIPE MATERIAL:
B2: SCH40, PVC
H2: DR11, HDPE
K2: PE ID TUBING

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER

Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
PROCESS
PROCESS & INSTRUMENTATION DIAGRAM
WELL SITE

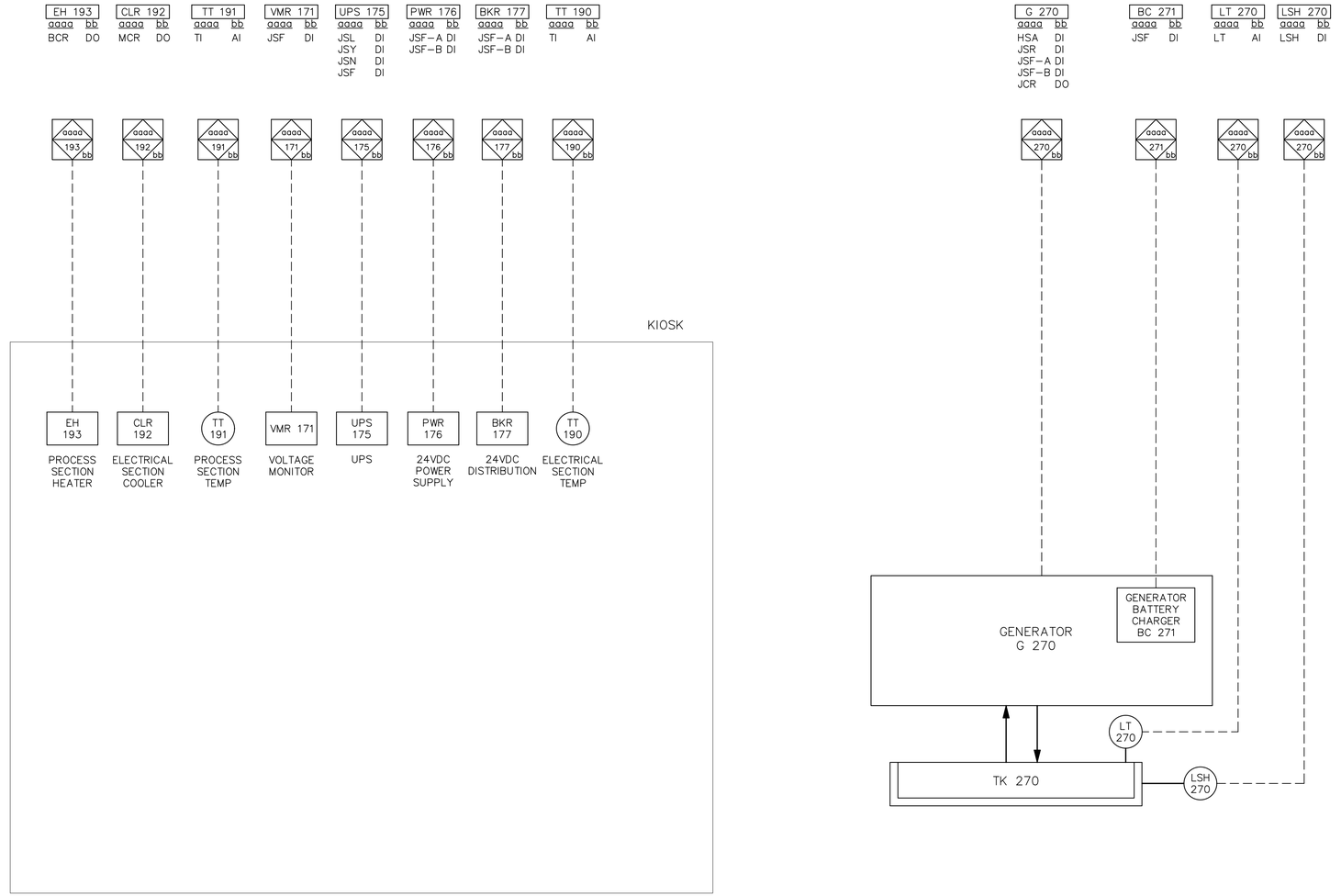
DESIGNED	J.M.H.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	P12.1

DESIGN CRITERIA

WELL PUMP
WP 101
TYPE: SUBMERSIBLE WELL PUMP
Q: XX L/S
H: XXm
XX HP, XX RPM, XXV, XXPH

WELL PUMP
WP 102
TYPE: SUBMERSIBLE WELL PUMP
Q: 3 L/S
H: 35m
2 HP, 3480 RPM, 575V, 3PH

LOW PRESSURE ULTRAVIOLET UV REACTOR
UV 211/212
Q: 3 L/S
MIN UVT 80%



NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL ITEMS SHOWN IN BOLD INDICATE WORK TO BE DONE. ALL ITEMS SHOWN IN LIGHT INDICATE EXISTING CONDITIONS. ALL ITEMS SHOWN IN LIGHT/DASHED INDICATE FUTURE WORK AND EQUIPMENT.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

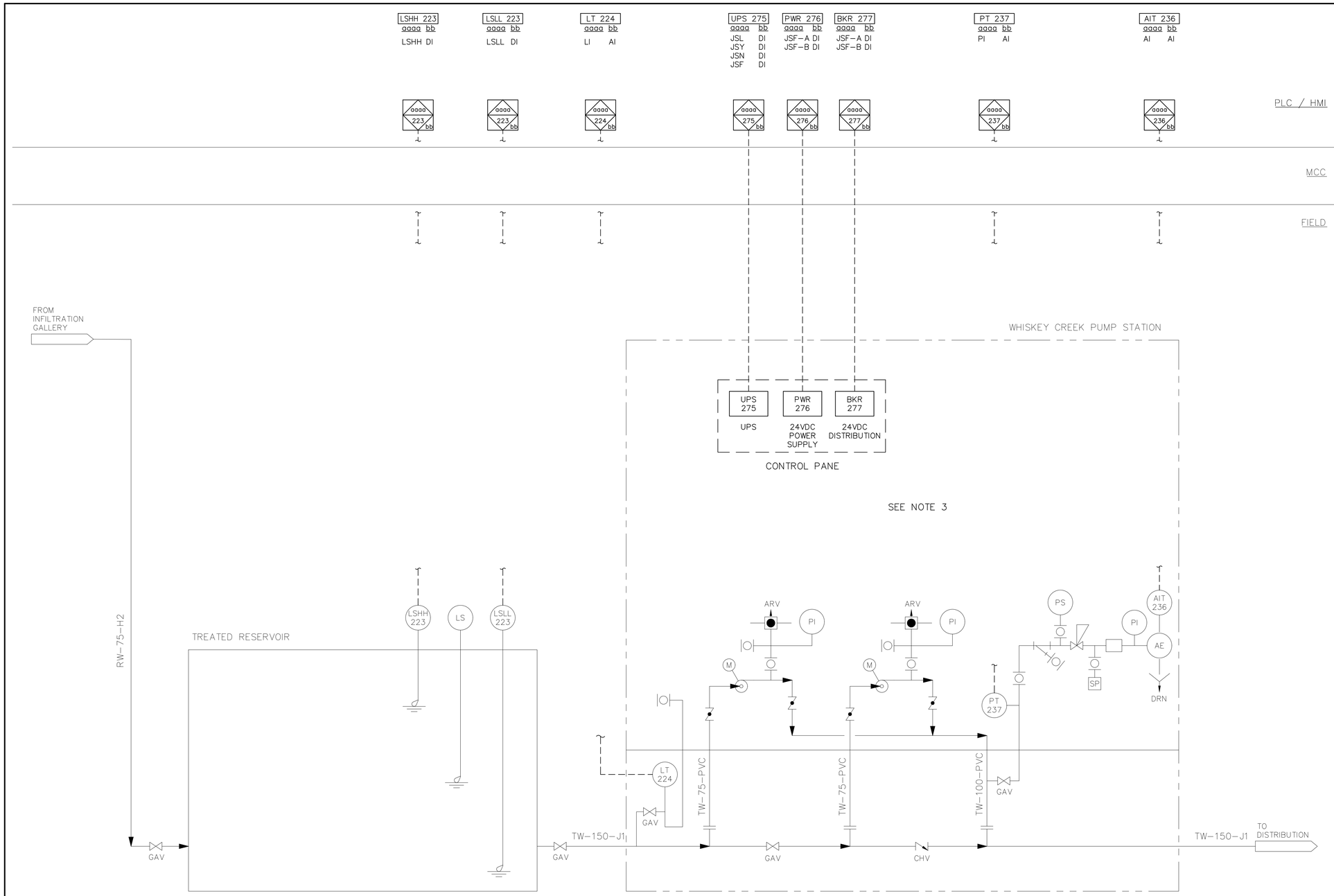
WHISKEY CREEK PHASE 1A
PROCESS
PROCESS & INSTRUMENTATION DIAGRAM
WELL SITE AUXILIARIES

DESIGN CRITERIA

TK 270
TYPE: SUB–BASE
DOUBLE CONTAINMENT

GENERATOR G 270
TYPE: DIESEL GENERATOR
CAPACITY: 60kW

DESIGNED	J.M.H.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	P12.2



TREATED RESERVOIR
R220
VOLUME: 220m³
L: ±12.6m
W: ±8.2m
D: ±2.2m TO 2.6m

DESIGN CRITERIA

NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL ITEMS SHOWN IN BOLD INDICATE WORK TO BE DONE. ALL ITEMS SHOWN IN LIGHT INDICATE EXISTING CONDITIONS. ALL ITEMS SHOWN IN LIGHT/DASHED INDICATE FUTURE WORK AND EQUIPMENT.
3. NO PROCESS EQUIPMENT CHANGES. EXISTING INSTRUMENTS TO BE CONNECTED TO NEW CONTROL SYSTEM AS SHOWN. RETAG EXISTING INSTRUMENTS AS SHOWN.

EQUIPMENT LEGEND:

- CENTRIFUGAL MULTISTAGE PUMP
- GATE (GAV)
- BUTTERFLY (BUV)
- BALL (BAV)
- CHECK (CHV)
- NORMALLY CLOSED (NC)
- ARV — AIR RELEASE
- STRAINER "Y" TYPE
- SAMPLE POINT (SP)

LINE IDENTIFICATION:
RW: RAW WATER
TW: TREATED WATER

PIPE MATERIAL:
H2: DR11, HDPE
J1: ASBESTOS CEMENT PIPE
PVC:

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER

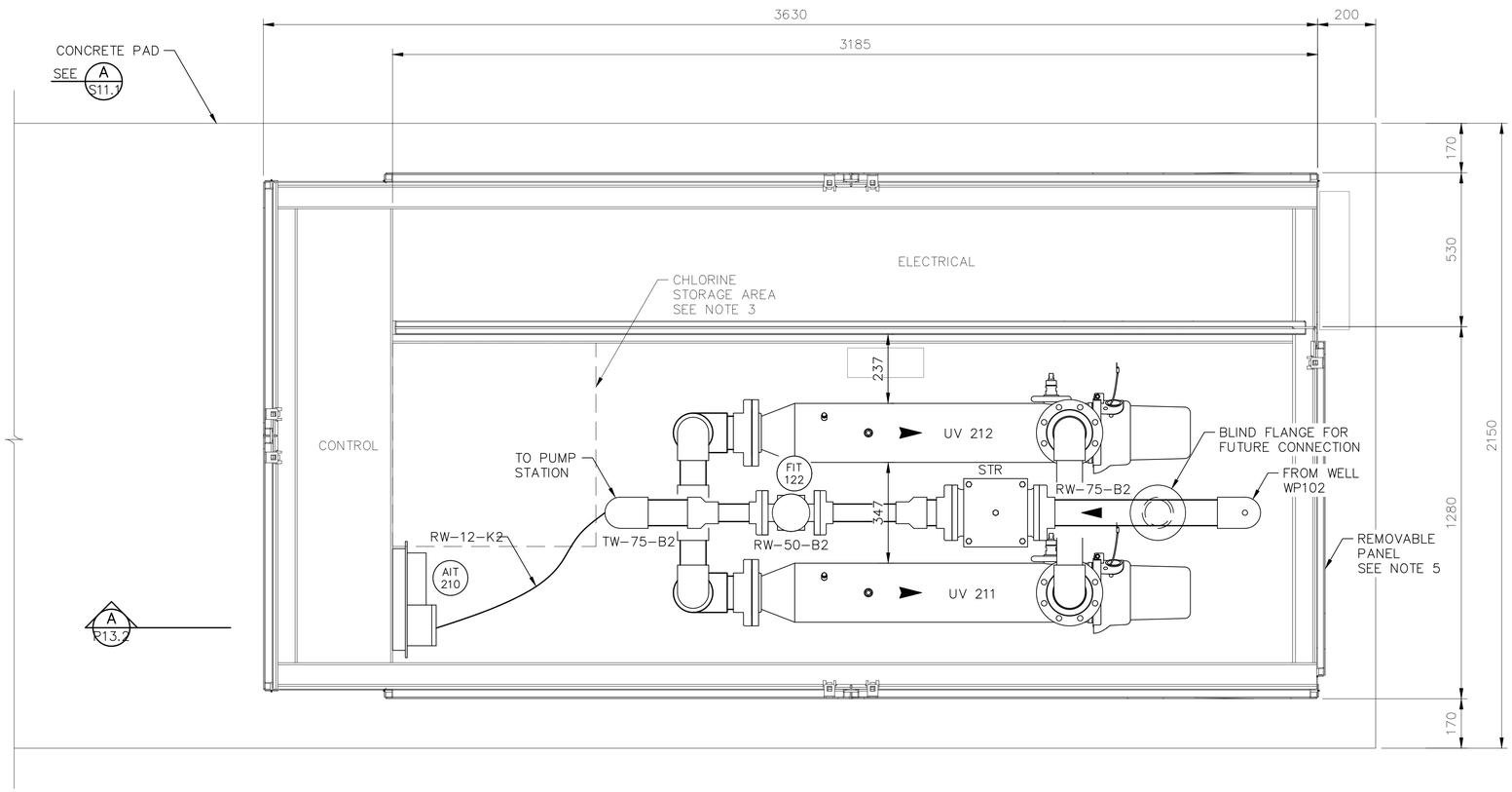
Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
PROCESS
PROCESS & INSTRUMENTATION DIAGRAM RESERVOIR AND PUMP STATION

DESIGNED	J.M.H.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	P22.1



NOTES:

1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. PROVIDE FLOOR SUPPORTS AS NEEDED. CONTRACTOR TO CONFIRM LOCATION WITH ENGINEER PRIOR TO INSTALLATION.
3. CHLORINE INJECTION PUMP AND CONTAINMENT TO BE SUPPLIED BY OWNER.
4. TURBIDITY METER TO BE RELOCATED FROM SURFACE WATER PUMP STATION.
5. PANEL ON SIDE OF KIOSK TO BE REMOVABLE FOR UV MAINTENANCE.
6. UV UNITS TO BE TROJAN UV SWIFT SC MODEL B04.

PIPING LEGEND:

- 90° ELBOW
- 90° ELBOW (DOWN)
- 90° ELBOW (UP)
- TEE
- FLANGE
- BLIND FLANGE
- CONCENTRIC REDUCER
- SP — SAMPLE POINT

LINE IDENTIFICATION:	PIPE MATERIAL:
RW: RAW WATER	B2: SCH40, PVC
TW: TREATED WATER	H2: DR11, HDPE
CLS: CHLORINE SOLUTION	K2: PE ID TUBING

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER

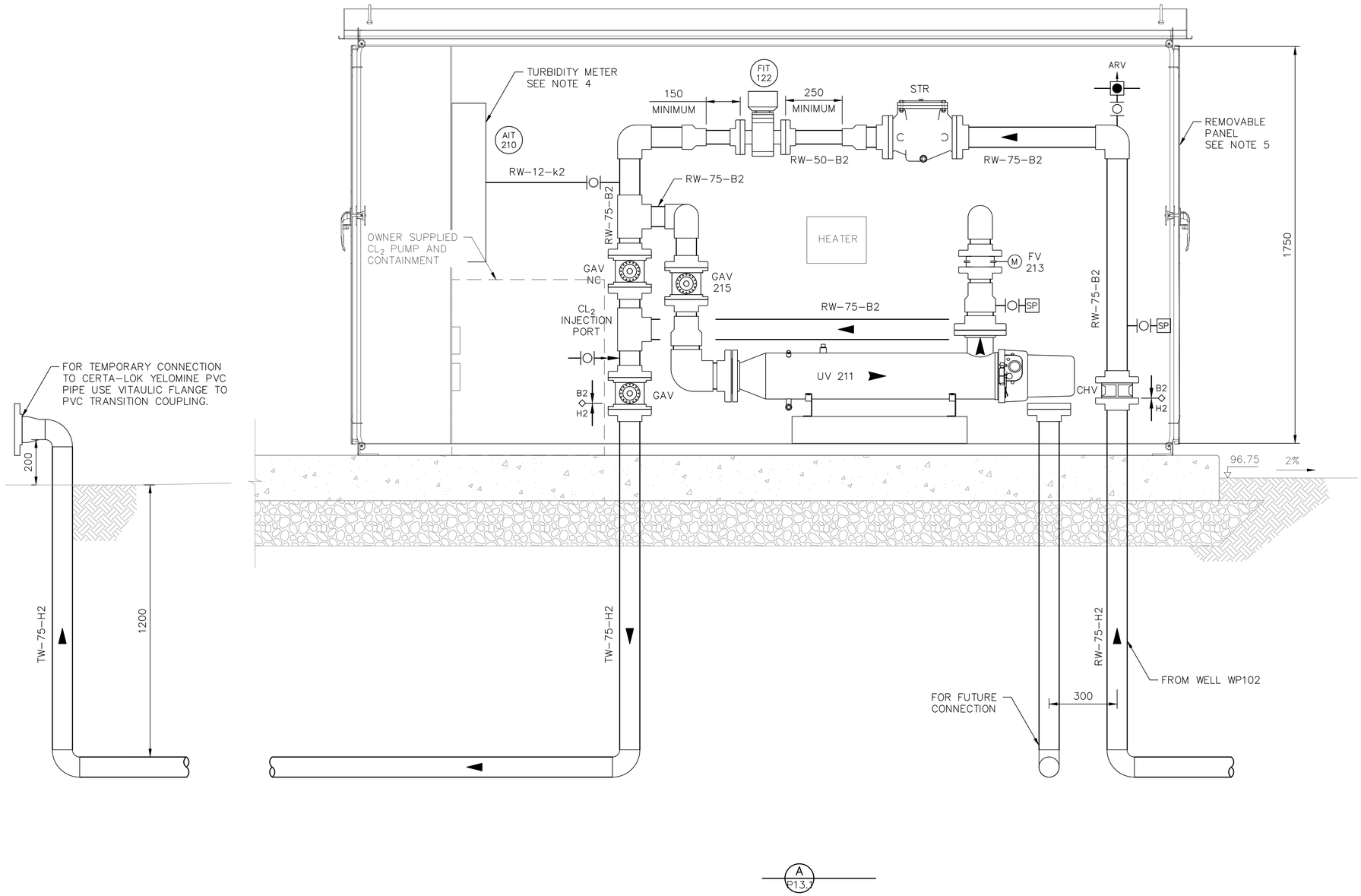
Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
PROCESS
WELL KIOSK LAYOUT

DESIGNED	J.M.H.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	P13.1



A
P13.1

NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. PROVIDE FLOOR SUPPORTS AS NEEDED. CONTRACTOR TO CONFIRM LOCATION WITH ENGINEER PRIOR TO INSTALLATION.
3. CHLORINE INJECTION PUMP AND CONTAINMENT TO BE SUPPLIED BY OWNER.
4. TURBIDITY METER TO BE RELOCATED FROM THE SURFACE WATER PUMP STATION.
5. PANEL ON SIDE OF KIOSK TO BE REMOVABLE FOR UV MAINTENANCE.

PIPING LEGEND:

- 90° ELBOW
- 90° ELBOW (DOWN)
- 90° ELBOW (UP)
- TEE
- FLANGE
- BLIND FLANGE
- CONCENTRIC REDUCER
- SP — SAMPLE POINT

LINE IDENTIFICATION:	PIPE MATERIAL:
RW: RAW WATER	B2: SCH40, PVC
TW: TREATED WATER	H2: DR11, HDPE
CLS: CHLORINE SOLUTION	K2: PE ID TUBING

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

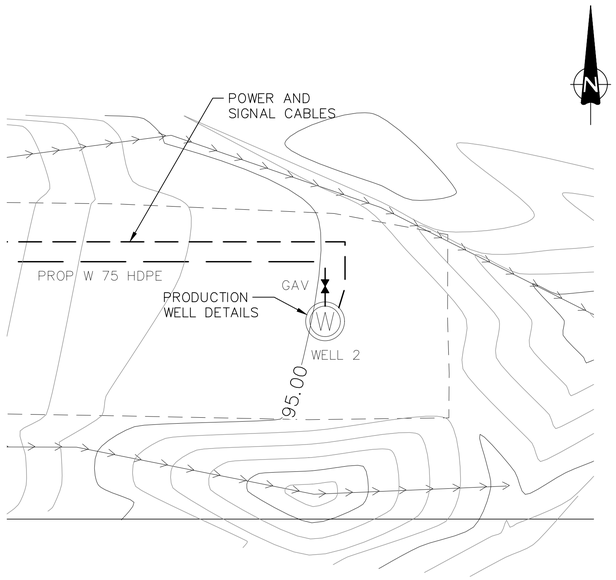
Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

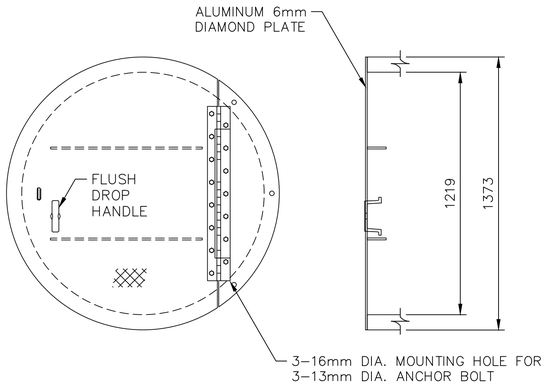
MPE Engineering Ltd.

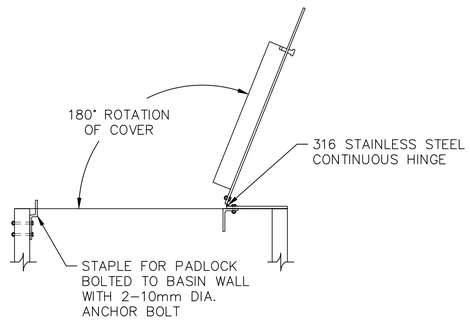
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
PROCESS
WELL KIOSK SECTION

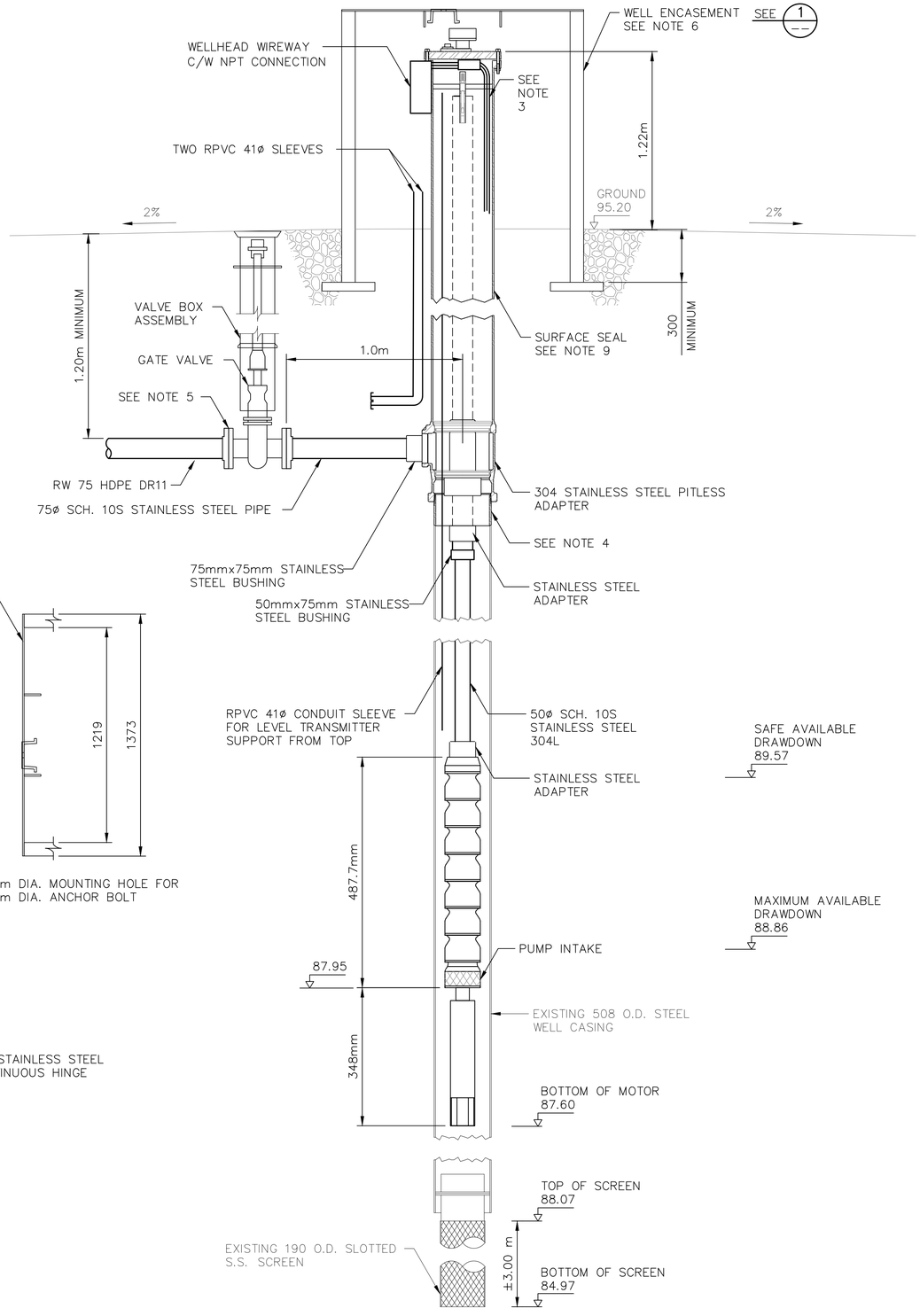
DESIGNED	J.M.H.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	P13.2







1



NOTES:

1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. SECURE PUMP CABLE AND LEVEL TRANSMITTER SLEEVE USING HEAVY PLASTIC ELECTRICAL SNAP TIES SPACED AT 3000mm INTERVALS.
3. PUMP POWER CABLE TO BE OF LENGTH TO REACH WELLHEAD WIREWAY PLUS 1 METER.
4. CONTRACTOR TO CUT OFF EXISTING CASING TO SUIT PITLESS UNIT. PITLESS UNIT TO WELD TO EXISTING PIPE CASING. MAASS MODEL MB WITH WATER TIGHT CAP.
5. ALL FITTINGS, FLANGES AND COUPLINGS TO MEET OR EXCEED PRESSURE RATING OF PIPE.
6. 1220mm DIAMETER MANHOLE WITH ACCESS HATCH. FILL MANHOLE WITH DRAINAGE ROCK TO GROUND ELEVATION. MANHOLE TO BE SET ON 4–300x300x50 CONCRETE BLOCKS. ACCESS HATCH TO BE USF–BPC, 1200mm ALUMINUM COVER.
7. ALL WELL RELATED WORK TO BE COMPLETED BY A B.C. REGISTERED WELL PUMP INSTALLER.
8. SUBMERSIBLE WELL PUMP:
   GRUNDFOS MODEL
   45520–5 (4 INCH, 2 HP, 5 STAGE)
   TO BE SUPPLIED WITH INTEGRAL CHECK VALVE
   GRUNDFOS MOTOR: MODEL MS402
   2 HP, 3 PH, 575V, 3450 RPM
9. 2" (50mm) BENTONITE SURFACE SEAL TO A DEPTH OF 5.2m IS TO BE MAINTAINED AND/OR REPLACED AS REQUIRED TO MEET THE GROUNDWATER PROTECTION GUIDELINES.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

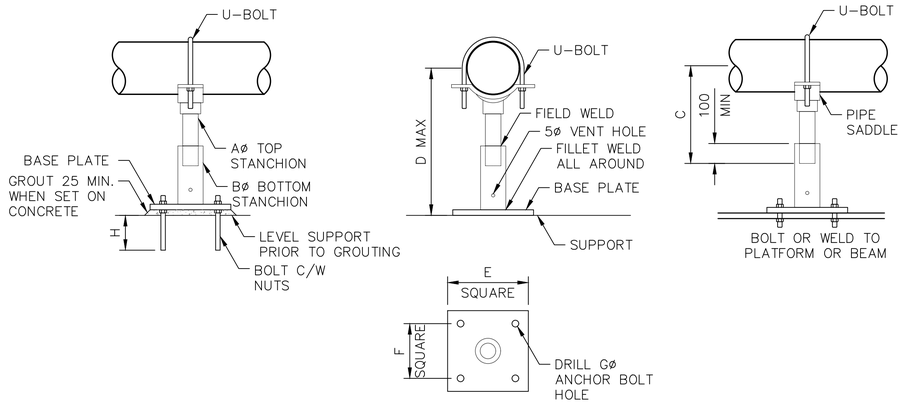
Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
PROCESS
WELL DETAILS

DESIGNED	J.M.H.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	P14.1

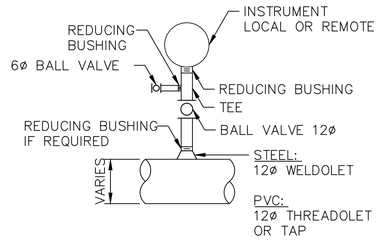


BASE PLATE

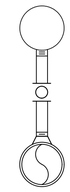
NOTES:
1. STANCHION MATERIAL SCH. 40 PIPE, OR AS PER SPECIFICATIONS.
   BASE PLATE – CARBON STEEL
   PIPE STANCHION SADDLE – MAY BE MYATT FIG. 306 OR ANVIL FIG. 259

PIPE SIZE		65	80	100	125	150	200	250	300	350	400	450	500	600
A		40	65	65	65	75	75	75	100	100	100	150	150	150
B		65	75	75	75	100	100	100	150	150	150	200	200	200
C	MIN	200	210	235	250	270	300	350	380	410	450	500	530	600
	MAX	330	340	350	375	390	420	460	500	530	570	610	650	720
D	MAX	1000	1200	1200	1200	1500	1500	1500	1800	1800	1800	2000	2000	2000
THICK x E SQUARE		8	8	8	8	12	12	12	12	12	12	16	16	16
		150	150	200	200	200	200	200	250	250	250	300	300	300
F SQUARE		100	100	150	150	150	150	150	190	190	190	240	240	240
G∅ x No. OF HOLES		15∅ x 4		20∅ x 4						25∅ x 4				
BOLT∅ x H		M12x100 HILTI HIT HY–150		M16x150 HILTI HIT HY–150						M20x150 (MIN) HILTI HIT HY–150				

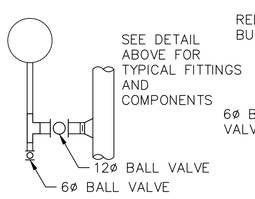
PIPE SUPPORT TYPE 1 STANCHION PIPE SUPPORT WITH SADDLE (ADJUSTABLE)
NTS



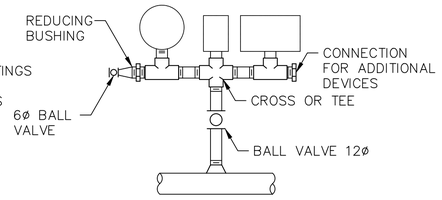
HORIZONTAL PIPING, TOP CONNECTION



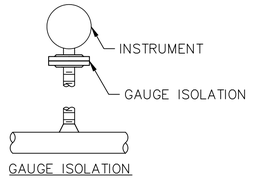
HORIZONTAL PIPING, SIDE CONNECTION



VERTICAL PIPING, SIDE CONNECTION



MULTI INSTRUMENT CONNECTION



GAUGE ISOLATION

INSTRUMENT CONNECTION DETAILS
NTS

NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. 20 CHAMFER ALL CONCRETE EDGES.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER

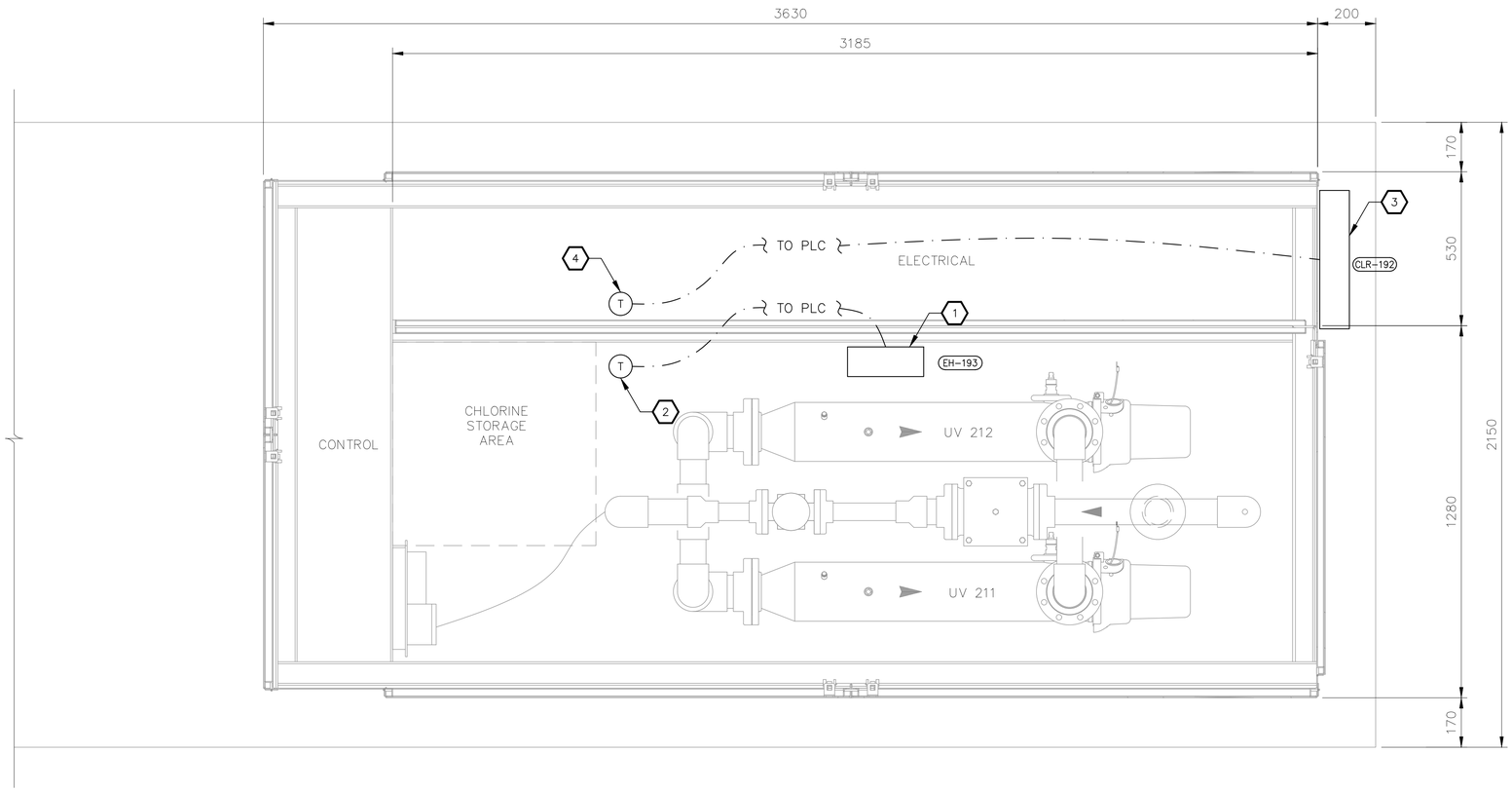
Association of Professional Engineers and Geoscientists of the Province of British Columbia
K. A. SCHURTZ
ENGINEERING LICENSEE
Limited Licence 51215
2021-01-22

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
PROCESS
MISCELLANEOUS DETAILS

DESIGNED	J.M.H.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	P15.1



NOTES:

1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE..

KEY NOTES:

1. EH-193: OUELETT OAC02008-RT 208/1/60 2000 WATTS WITH CONTROL RELAY AND TRANSFORMER. INCLUDE SURFACE MOUNTING BOX KIT-OAC-BS1. MOUNT 800MM AFF.
2. LOCATE TEMPERATURE SENSOR AT LOCATION SHOWN. EH-193 TO MAINTAIN SPACE TEMP AT 15° IN HEATING CONDITION.
3. CLR-192: NOREN CC901F-WL-RH9 1254 WATTS COOLING CAPACITY @ 20°ΔT C/W STAINLESS STEEL. OUTDOOR HOOD & BIRD SCREEN ON AIR INLET AND EXHAUST. 120/1/60 POWER. MOUNT 900mm A.F.F.
4. LOCATE TEMPERATURE SENSOR AT LOCATION SHOWN. CLR192 TO MAINTAIN SPACE TEMPERATURE AT 25 IN COOLING CONDITION.

LEGEND:

(T) TEMPERATURE SENSOR

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
MECHANICAL
WELL KIOSK MECHANICAL LAYOUT

DESIGNED	C.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	M11.1

CABLE AND CONDUIT

- CONDUIT IDENTIFICATION TAG
- OH — OVERHEAD POWER
- UG — UNDERGROUND POWER
- CONDUCTOR/CONDUIT
- UNDERGROUND CONDUCTOR/CONDUIT
- FLEXIBLE CONDUIT
- EXISTING EQUIPMENT
- NEW EQUIPMENT
- EQUIPMENT TO BE REMOVED
- HR — CONDUIT HOME RUN
- CABLE TRAY
- SURFACE RACEWAY

POWER EQUIPMENT

- J — JUNCTION BOX
- PB — PULL BOX
- DELTA WYE TRANSFORMER
- DISTRIBUTION TRANSFORMER
- POTENTIAL TRANSFORMER
- UTILITY METERING — UTILITY METER SINGLE LINE
- UTILITY METER PLAN
- FUSE DRAW OUT TYPE
- CIRCUIT BREAKER DRAW OUT TYPE
- 3 PHASE GENERATOR (GROUNDED)
- THERMAL OVERLOAD PROTECTION
- I — INTERLOCK
- CAPACITOR
- A — CURRENT METER
- HP — MOTOR HP
- CONTACTOR
- FUSE
- EXTERNALLY OPERATED DISCONNECT SWITCH
- DISCONNECT SWITCH
- FUSED DISCONNECT SWITCH
- BREAKER CIRCUIT — FRAME SIZE / TRIP RATING / POLE
- ETM — ELAPSED TIME METER
- GROUND ROD
- GROUND ROD C/W WELL
- GROUND ROD WITHOUT WELL
- GH — GATE HOIST
- VFD — VARIABLE FREQUENCY/SPEED DRIVE
- x kW — HEATER C/W KILOWATT RATING
- XXX — MOTOR CONTROL IDENTIFICATION TAG
- TRANSFER SWITCH

CONTROL PANEL EQUIPMENT

- RESET PUSH BUTTON (NO)
- RESET PUSH BUTTON (NC)
- MUSHROOM HEAD STOP
- 3 POSITION SELECTOR SWITCH (H, O, A)
- 2 POSITION SELECTOR SWITCH (ON, OFF)
- HAND–OFF–AUTO SELECTOR SWITCH (H, O, A)
- UP–OFF–DOWN SELECTOR SWITCH (U, O, D)
- RESET PUSH BUTTON
- A — AMBER PILOT LIGHT
- G — GREEN PILOT LIGHT
- R — RED PILOT LIGHT
- DUPLEX RECEPTACLE
- SINGLE PHASE PLUG
- F — MAIN CONTROL PANEL FUSED TERMINAL BLOCK
- F — AUXILARY FUSED TERMINAL BLOCK
- CIRCUIT BREAKER
- MAIN CONTROL PANEL TERMINAL BLOCK
- PLC/RTU TERMINAL
- AUXILARY TERMINAL BLOCK
- MCC/VFD TERMINAL BLOCK
- DEVICE TERMINAL BLOCK
- R 1000 — DRY CONTACT RELAY
- TD 1000 — TIME DELAY RELAY
- M — MAGNETIC CONTACTOR
- DRY CONTACT RELAY (NC)
- DRY CONTACT RELAY (NO)
- VARIABLE RESISTOR
- RESISTOR
- TH — THERMISTOR
- SOLENOID
- DIODE
- MOV — METAL OXIDE VARISTOR
- 10011 — FEED THROUGH TERMINAL BLOCK
- F10011 — FUSED TERMINAL BLOCK

PLC I/O

- PLC DI — PLC/RTU DIGITAL INPUT
- PLC DO — PLC/RTU DIGITAL OUTPUT
- PLC AI — PLC/RTU ANALOG INPUT
- PLC AO — PLC/RTU ANALOG OUTPUT

INSTRUMENTATION EQUIPMENT

- LEVEL SWITCH (OPEN ON RISING LEVEL)
- LEVEL SWITCH (OPEN ON FALLING LEVEL)
- FLOW SWITCH (OPEN ON RISING FLOW)
- FLOW SWITCH (OPEN ON FALLING FLOW)
- PRESSURE SWITCH (OPEN ON RISING PRESSURE)
- PRESSURE SWITCH (OPEN ON FALLING PRESSURE)
- THERMOSTAT (OPEN ON RISING TEMPERATURE)
- THERMOSTAT (OPEN ON FALLING TEMPERATURE)
- LIMIT SWITCH (NC)
- LIMIT SWITCH (NO)
- TIME DELAY RELAY (NC)
- TIME DELAY RELAY (NO)
- XXX / XXX — INSTRUMENTATION IDENTIFICATION TAG

MECHANICAL EQUIPMENT

- EQUIPMENT IDENTIFICATION TAG
- FIRE EXTINGUISHER
- T — THERMOSTAT
- DM — DAMPER MOTOR

COMMUNICATION AND DATA

- DATA OUTLET
- C — PHONE OUTLET BOX CEILING
- F — PHONE OUTLET BOX FLOOR
- COMBINATION PHONE/DATA OUTLET
- PHONE OUTLET BOX MODULAR FURNITURE
- TV — TELEVISION
- WI — INTERNET MODULE WIRELESS
- HS — HAND SET
- L — CLOCK
- S — SPEAKER
- WALL MOUNT INTERCOM SPEAKER
- WALL PHONE
- MICROPHONE OUTLET
- MIC — MICROPHONE
- RADIO LINK

RECEPTACLES

- SINGLE
- DUPLEX 5–15R
- CT — DUPLEX ABOVE COUNTERTOP
- U — DUPLEX BELOW (UNDER) COUNTERTOP
- 20 — DUPLEX 5–20R
- C — DUPLEX COMPUTER SURGE
- S — DUPLEX SPLIT
- GFI — DUPLEX GROUND FAULT
- IG — DUPLEX ISOLATED GROUND
- WP — DUPLEX WEATHER PROOF
- 3 PHASE
- QUAD
- SPECIAL OUTLET BOX

LUMINAIRE AND LUMINAIRE CONTROLS

- XXX — LUMINAIRE IDENTIFICATION TAG
- $ — SINGLE POLE SWITCH
- $T — TIMER SWITCH
- $3 — THREE WAY SWITCH
- $4 — FOUR WAY SWITCH
- $► — OCCUPANCY MOTION SWITCH
- $K — KEY SWITCH
- $347 — 347 VOLT SWITCH
- $D — DIMMER SWITCH
- $R — LOW VOLTAGE LIGHTING CONTROL SWITCH
- $M — MANUAL STARTER SWITCH
- OS — OCCUPANCY MOTION SENSOR
- NIGHT LIGHT
- FLUORESCENT LIGHT FIXTURE
- DISTRIBUTION PANEL BOARD
- FLUORESCENT STRIP FIXTURE
- TRACK LIGHTING C/W LIGHTING HEADS AS SHOWN
- SURFACE H.I.D. LUMINAIRE
- POLE MOUNTED LUMINAIRE
- SURFACE MOUNTED LIGHT
- WALL MOUNTED LIGHT
- RECESSED LIGHT
- EMERGENCY LIGHT
- REMOTE DC HEAD
- DOUBLE REMOTE DC HEAD
- EXIT LIGHT WITH DC HEADS
- EXIT LIGHT OUTLET WITH DIRECTIONAL ARROWS AS SHOWN
- PHC — PHOTO CELL

SECURITY

- MOTION SENSOR
- 360° MOTION SENSOR
- CAMERA
- PUSH BUTTON
- ES — ELECTRIC STRIKE
- BG — BREAK GLASS
- SA — SONALERT
- DL — MAGNETIC DOOR LOCK
- DC — SECURITY DOOR CONTACTS
- CR — CARD READER
- KP — SECURITY KEY PAD
- PC — EMERGENCY CALL PULL CORD
- ST — EMERGENCY CALL SUITE TELECOM
- BC — EMERGENCY BEDSIDE CALL CORD
- NC — EMERGENCY CALL STATION
- WT — TELEPHONE TRANSMITTER WIRELESS
- WN — NURSE CALL MODULE WIRELESS
- LF C — NURSE CALL MODULE CEILING MOUNTED
- LF W — NURSE CALL MODULE WALL MOUNTED

FIRE ALARM

- FIRE ALARM BELL
- FIRE ALARM BELL AND STROBE
- FIRE ALARM HORN
- FIRE ALARM HORN AND STROBE
- S W — FIRE ALARM SPEAKER WALL MOUNT
- S W — FIRE ALARM SPEAKER STROBE COMBINATION WALL MOUNTED
- S C — FIRE ALARM SPEAKER CEILING MOUNT
- S C — FIRE ALARM SPEAKER STROBE COMBINATION CEILING MOUNTED
- TR — TERMINATING RESISTOR
- FIRE SUPPRESSION — FIRE SUPPRESSION
- FA — FIRE ALARM PANEL/ANNUNCIATOR
- SD — SMOKE DETECTOR
- HD — HEAT DETECTOR
- DD — DUCT DETECTOR
- ESA — ELECTRONIC SMOKE ALARM
- FP — FIRE ALARM PULL STATION
- FCR — FIRE ALARM CONTROL RELAY
- ISO — FIRE ISOLATION MODULE
- FS — FIRE ALARM FLOW SWITCH
- TS — FIRE ALARM TAMPER SWITCH
- IM — FIRE ALARM INPUT MODULE
- DH — DOOR HOLDER

NOTES:

1. ALL BOLD ITEMS INDICATE WORK TO BE DONE AND ALL LIGHT ITEMS INDICATE EXISTING CONDITIONS.

THE EXISTENCE, LOCATION AND ELEVATION OF ALL UTILITIES AS SHOWN ON ANY PLANS MAY BE BASED ON INFORMATION RECEIVED FROM THE RESPECTIVE AUTHORITIES AND ARE NOT GUARANTEED BY THE ENGINEER. NO RESPONSIBILITY IS IMPLIED OR ASSUMED BY THE ENGINEER AS TO THE LOCATION AND ELEVATION OR ANY OMISSIONS. THE CONTRACTOR OR ANY THIRD–PARTY IS RESPONSIBLE FOR DETERMINING THE EXISTENCE, LOCATION AND ELEVATION OF ALL SUCH UTILITIES AND MUST CONTACT THE VARIOUS UTILITY COMPANIES FOR ON SITE INFORMATION PRIOR TO COMMENCEMENT OF ANY OPERATIONS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY–MM–DD	REVISION
1	21–01–22	FOR TENDER

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — P.P. GOERTZEN #46152

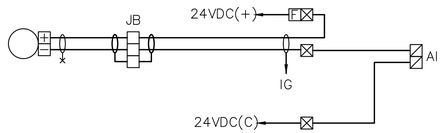
January 22, 2021

MPE Engineering Ltd.

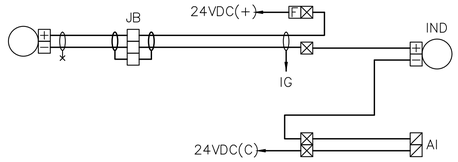
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
LEGEND

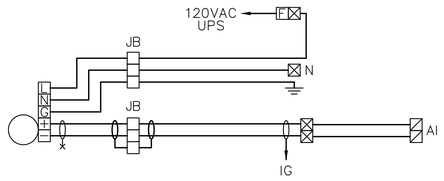
DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E00.1



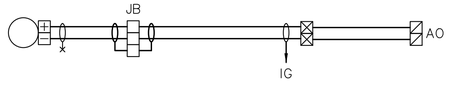
2 WIRE TRANSMITTER



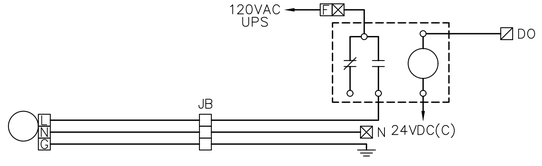
2 WIRE TRANSMITTER WITH PANEL INDICATION



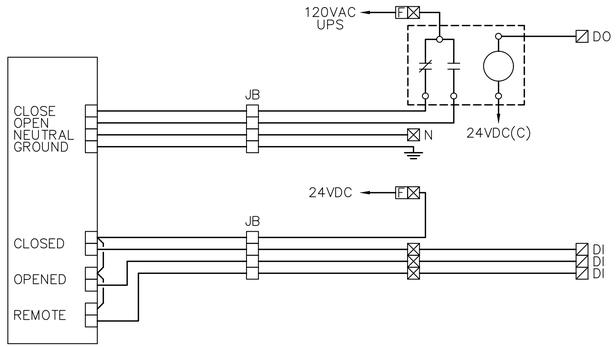
4 WIRE TRANSMITTER



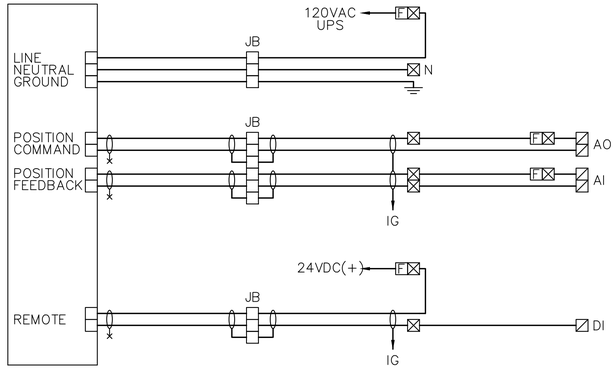
ANALOG OUTPUT



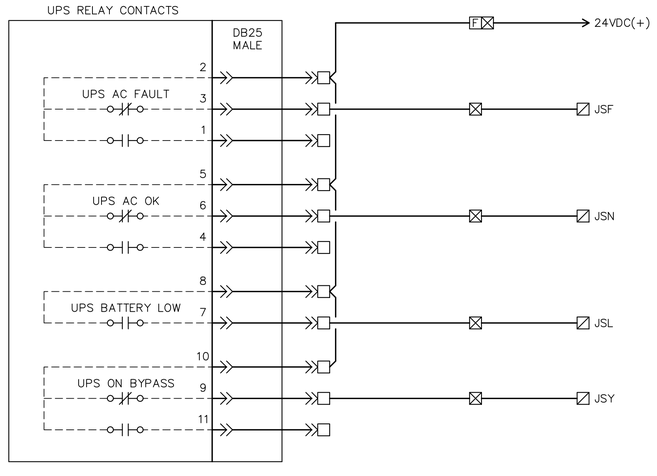
SOLENOID VALVE



NON–MODULATING MOTOR OPERATED VALVE



MODULATING MOTOR OPERATED VALVE



ALWAYS–ON UPS RELAY CONTACT SCHEMATIC

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. JUNCTION BOX (JB) MAY NOT BE USED IN ALL INSTALLATIONS.
3. GROUNDING OF INSTRUMENTS (CHASSIS) REQUIRED EVEN IF NOT SHOWN ON TYPICAL.
4. WHERE DRAIN WIRE IS TO BE ISOLATED, TRIM FOIL AND DRAIN WIRE FLUSH WITH JACKET AND APPLY MINIMUM 20MM OPAQUE HEAT SHRINK CENTRED OVER THE END OF JACKET.
5. WHERE DRAIN WIRE IS TO BE TERMINATED, TRIM FOIL FLUSH WITH JACKET. APPLY TRANSPARENT HEAT SHRINK OVER EXPOSED LENGTH OF DRAIN WIRE. APPLY MINIMUM 20MM OPAQUE HEAT SHRINK CENTRED OVER END OF JACKET/FOIL.
6. WHERE SHIELD DRAINS ARE GROUNDED AT THE CONTROL PANEL THEN THESE ARE TO BE COMMONED TOGETHER ON AN ISOLATED INSTRUMENT GROUND WITH A SINGLE CONNECTION TO THE ELECTRICAL SAFETY GROUND.

X = SHIELD/DRAIN ISOLATION
IG = ISOLATED GROUND

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

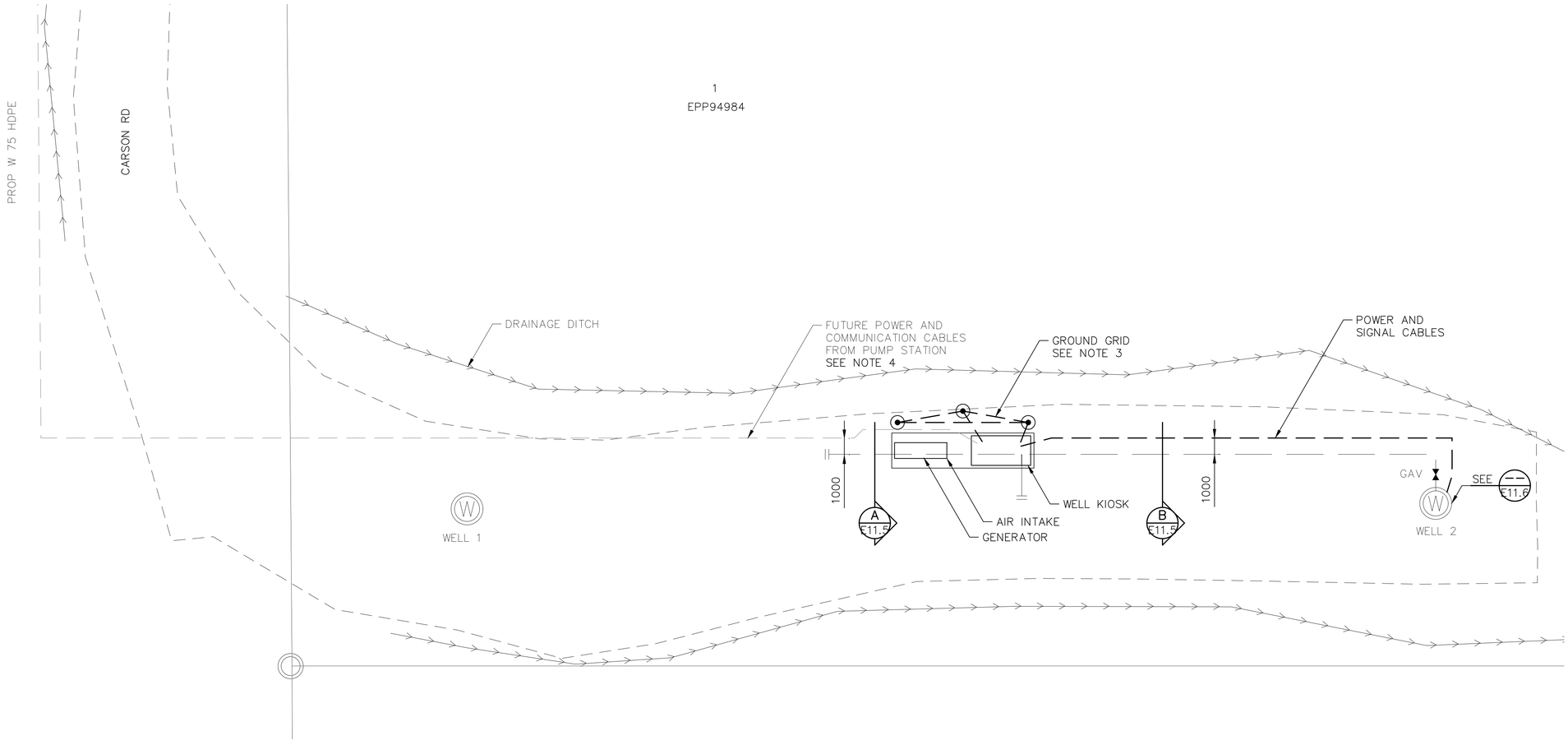
PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.F.GOERTZEN
#48152
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
INSTRUMENT WIRING TYPICALS

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E00.2



NOTES:

1. ALL PIPE SIZES ARE IN MILLIMETRES AND ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL BOLD ITEMS INDICATE WORK TO BE DONE AND ALL LIGHT ITEMS INDICATE EXISTING CONDITIONS.
3. GROUNDING:
   - THERE MUST BE AT LEAST THREE COPPER CLAD MANUFACTURED ROD ELECTRODES C/W GROUND CLAMP.
   - EACH ROD SHALL BE MINIMUM 19mm DIAMETER AND 3m LENGTH.
   - THE RODS MUST BE SPACED MINIMUM 3m APART.
   - THE RODS MUST BE BONDED TOGETHER BY BARE No.6 GROUNDING CONDUCTOR.
   - GROUND WELL TO BE ACE MANUFACTURING MODEL AGW.
4. IN FUTURE UPGRADE, GENERATOR WILL BE RELOCATED TO PUMP STATION AND POWER FOR WELL KIOSK WILL BE FED FROM PUMP STATION VIA UNDERGROUND CABLE. FIBER OPTIC CABLE FOR COMMUNICATIONS WILL BE INSTALLED WITH POWER CABLE.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
48152

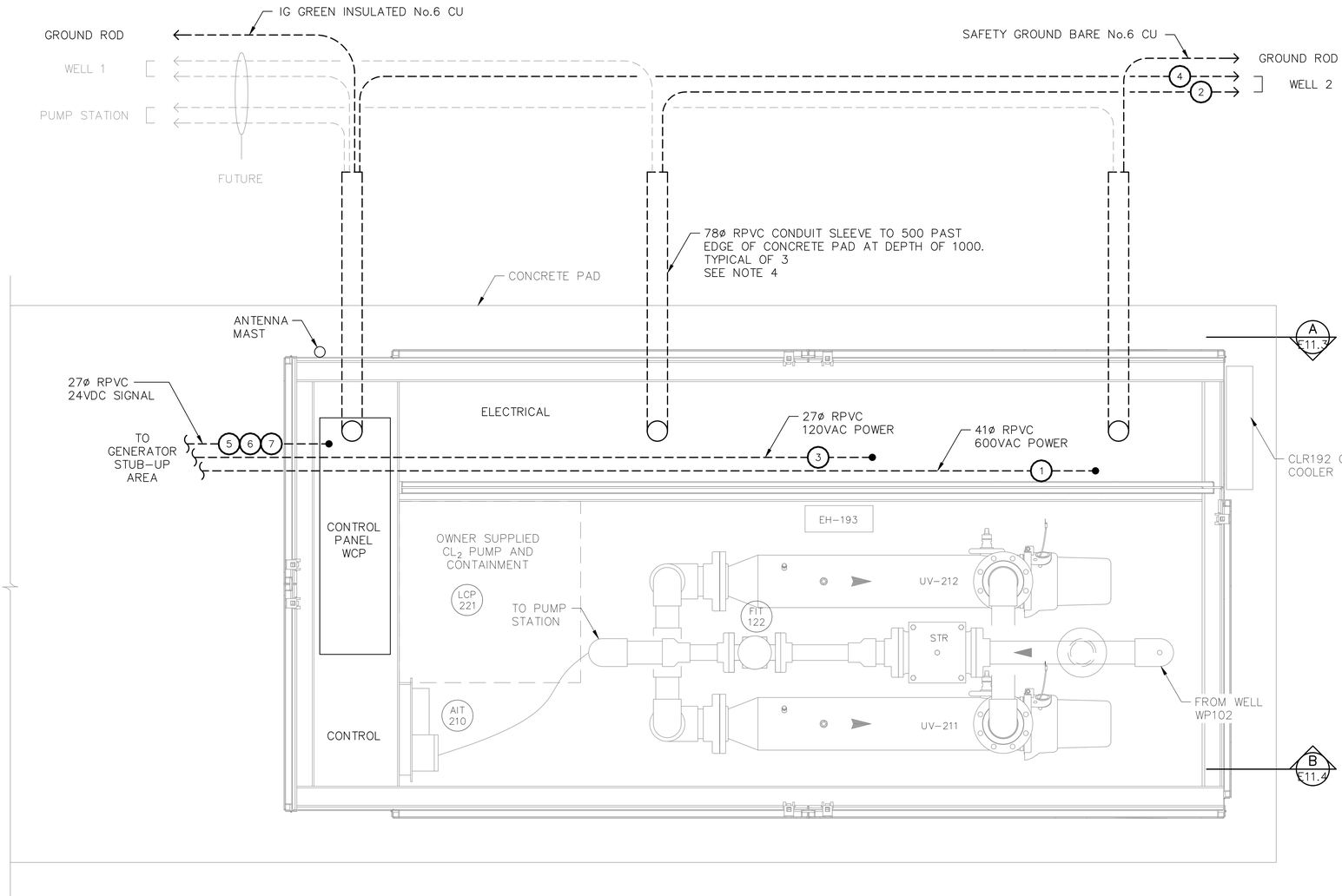
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELL SITE PLAN

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:250
DATE	JANUARY 2021	DRAWING	E11.1



NOTES:

1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. EACH COMPARTMENT TO HAVE LED STRIP LIGHTING MOUNTED ON CEILING. STRIP LIGHTING LENGTH TO MATCH COMPARTMENT LENGTH. LIGHTING TO BE CONTROLLED BY DOOR SWITCH ON PRIMARY DOOR OF COMPARTMENT.
3. INSTALL REMOVABLE SEALANT IN UNDERGROUND CONDUIT END.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.P. GOERTZEN #46152

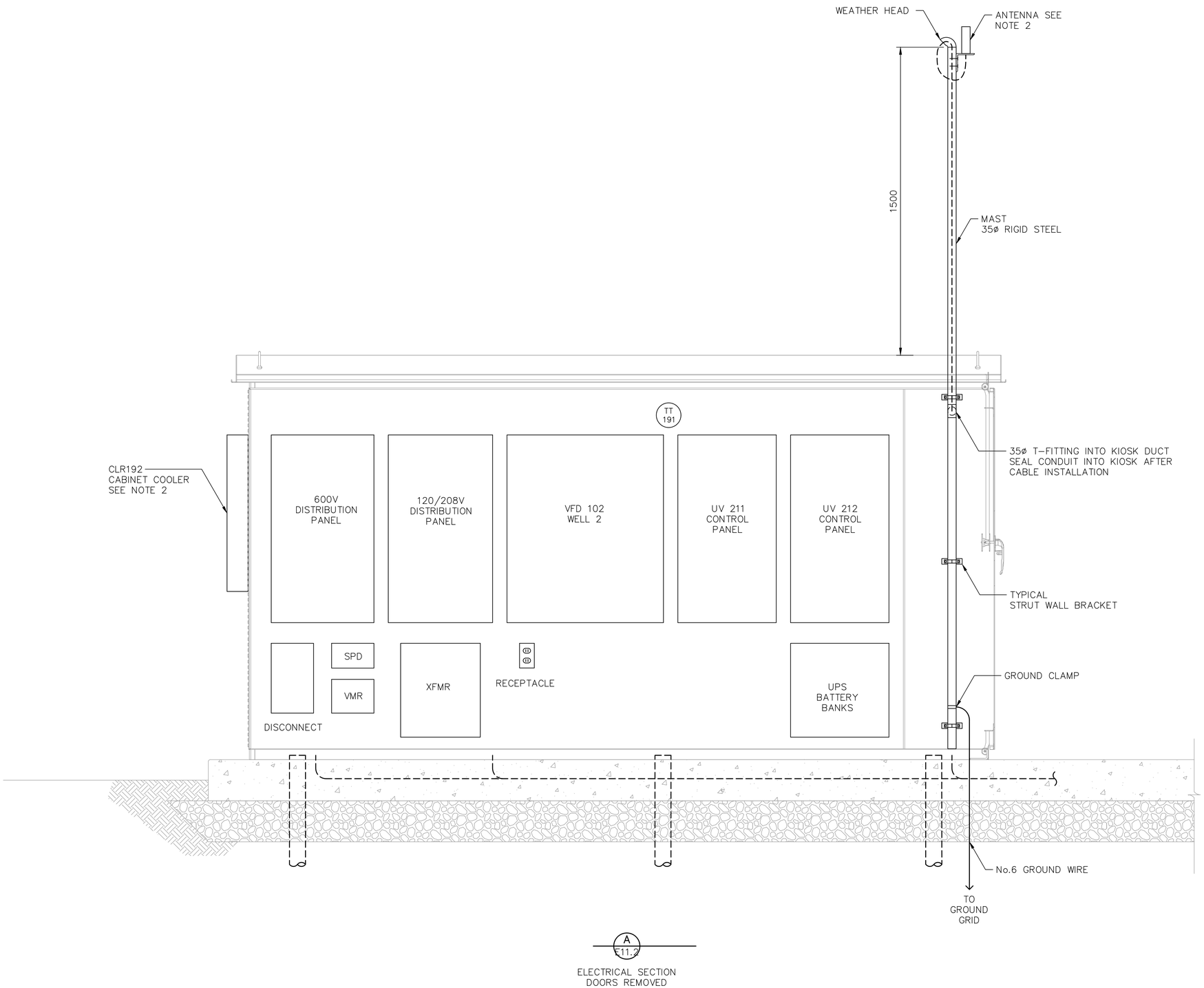
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELL KIOSK FLOOR PLAN

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	E11.2



NOTES:

1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. REFER TO CONTROL PANEL BILL OF MATERIALS FOR COMPONENTS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
#48152

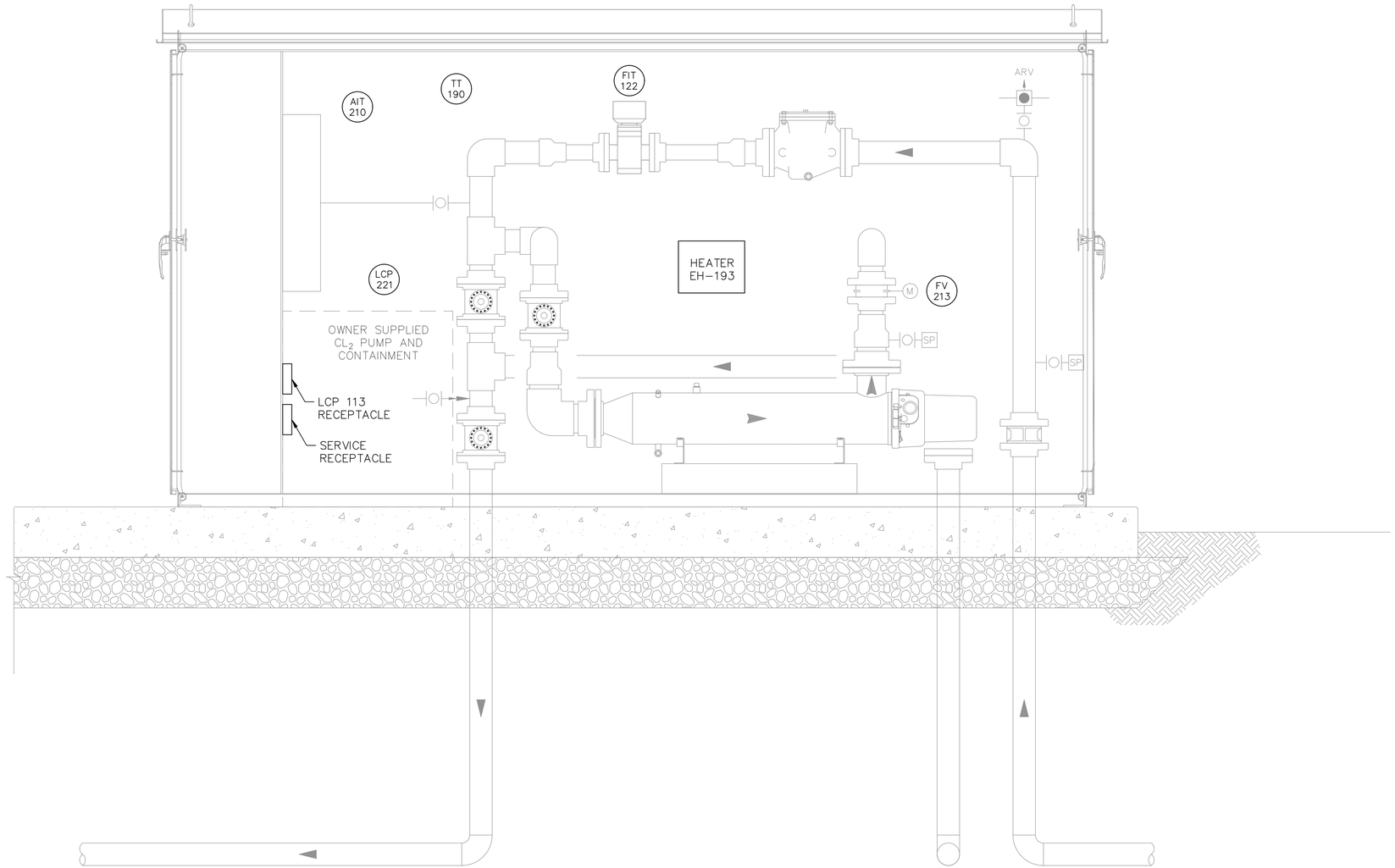
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELL KIOSK SECTION

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	E11.3



B
E11.2

NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
#48152

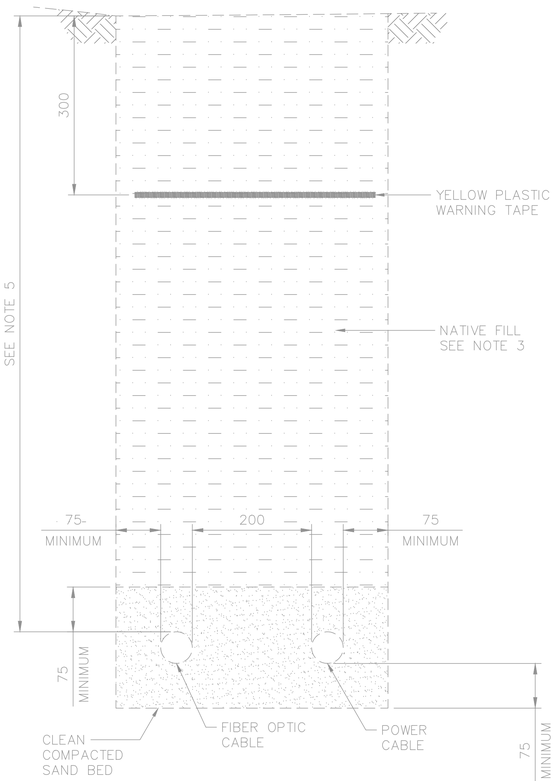
January 22, 2021

MPE Engineering Ltd.

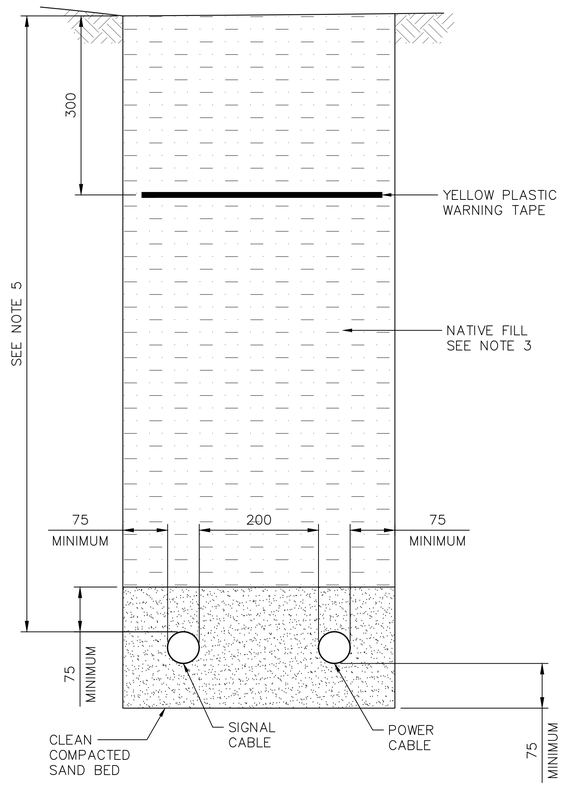
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELL KIOSK SECTION

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	E11.4



A
E11.1
FUTURE



B
E11.1

NOTES:
1. ALL ELEVATIONS AND STATIONS ARE IN METERS ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. CONTRACTOR TO CONFIRM ALL CASINGS AND CABLE.
3. THE NATIVE FILL SHOULD BE COMPACTED TO 95% STANDARD PROCTOR DENSITY.
4. BURIED CONDUIT SHALL NOT CROSS EACH OTHER.
5. MINIMUM DEPTH 1000. DEPTH IS TO FINAL GRADE.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
#48152

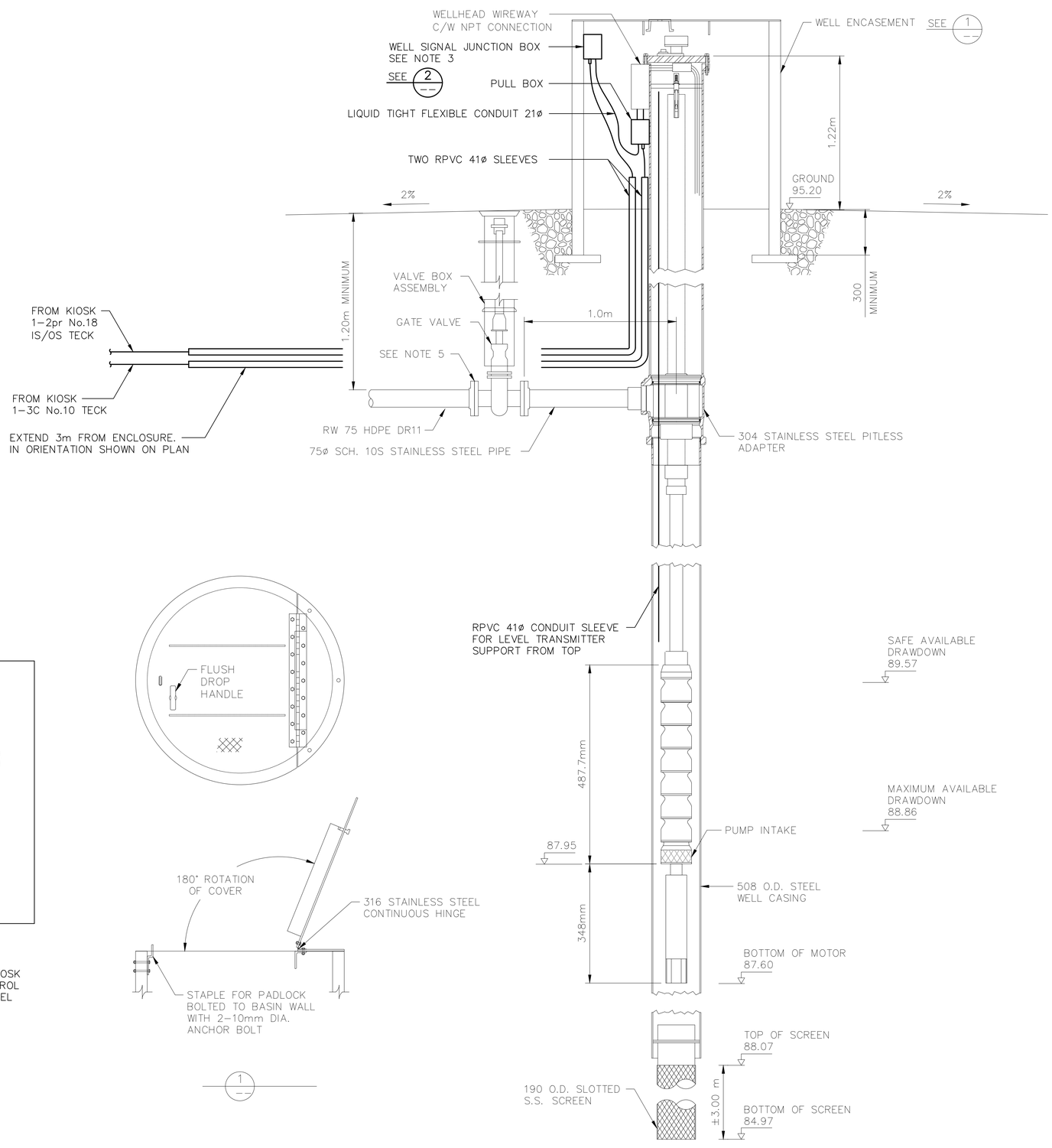
January 22, 2021

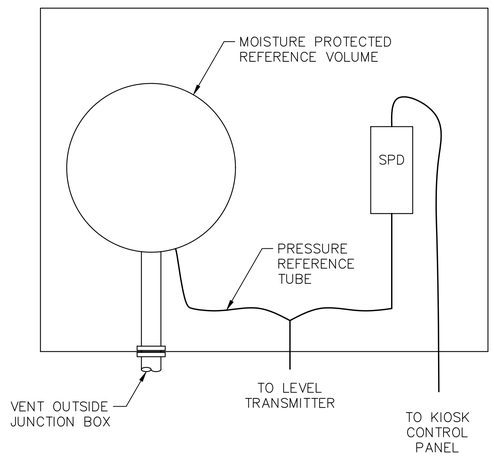
MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
UNDERGROUND CABLE DETAILS

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:10
DATE	JANUARY 2021	DRAWING	E11.5





WELL SIGNAL JUNCTION BOX DETAIL

2

SEE NOTE 4

1

NOTES:

1. ALL ELEVATIONS AND STATIONS ARE IN METERS UNLESS NOTED OTHERWISE. ALL DIMENSIONS AND PIPE SIZES ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. SUBMERSIBLE WELL PUMP:
   GRUNDFOS MODEL
   45520–5 (4 INCH, 2 HP, 5 STAGE)
   TO BE SUPPLIED WITH INTEGRAL CHECK VALVE
   GRUNDFOS MOTOR: MODEL MS402
   2 HP, 3 PH, 575V, 3450 RPM
3. WELL SIGNAL JUNCTION BOX TO BE INSTALLED JUST BELOW TOP OF WELL ENCASEMENT TO ALLOW FOR EASY ACCESS WHEN ENCASEMENT COVER OPEN.
4. JUNCTION BOX AND REFERENCE VOLUME SUPPLIED WITH LEVEL TRANSMITTER. REFER TO WELLS SIGNAL WIRING DIAGRAM FOR SPD.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
#46152

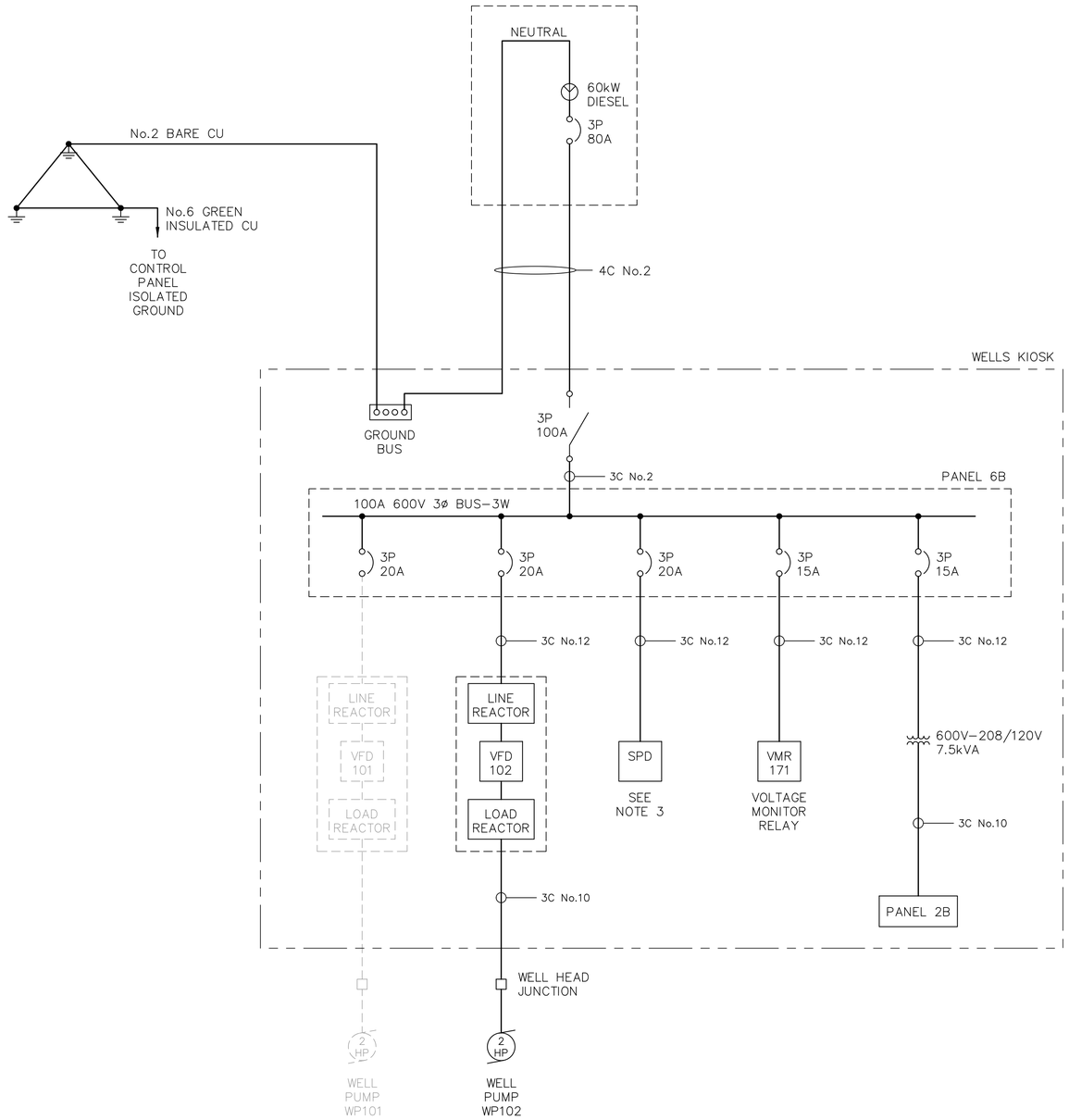
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELL DETAILS

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E11.6



NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS AND SYMBOLS REFER TO THE LEGEND DRAWINGS.
2. ALL PROPOSED ITEMS ARE SHOWN IN DARK BOLD WITH ALL EXISTING IN LIGHT.
3. SPD TO BE SURGE PURE M2-1600-3, 3ø 600V.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.F. GOERTZEN
#48152

January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS
SINGLE LINE DIAGRAM

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E12.1

	PANEL 6B SCHEDULE					
	LOCATION: WELLS KIOSK					
	600V, 3ø, 3W, 100A LUGS ONLY					
DESCRIPTION	TRIP AMPS	BRK. No.	PHASE A B C	BRK. No.	TRIP AMPS	DESCRIPTION
VFD WP102	20	1	A	2	15	PANEL 2B TRANSFORMER
	20	3	B	4	15	
	20	5	C	6	15	
SPD	20	7	A	8	15	VOLTAGE MONITOR RELAY VM 171
	20	9	B	10	15	
	20	11	C	12	15	
SPACE		13	A	14		SPACE
SPACE		15	B	16		SPACE
SPACE		17	C	18		SPACE

	PANEL 2B SCHEDULE					
	LOCATION: WELLS KIOSK					
	120/208V, 3ø, 3W, 100A LUGS ONLY					
DESCRIPTION	TRIP AMPS	BRK. No.	PHASE A B C	BRK. No.	TRIP AMPS	DESCRIPTION
KIOSK LIGHTING	15	1	A	2	20	CONTROL PANEL UPS
ELECTRICAL SECTION COOLER CLR-192	15	3	B	4	15	PROCESS SECTION HEATER EH-193
ELECTRICAL SECTION RECEPTACLE	15	5	C	6	15	
PROCESS SECTION RECEPTACLE	15	7	A	8	15	SPARE
CONTROL PANEL SERVICE RECEPTACLE	15	9	B	10	15	SPARE
UV1	15	11	C	12	15	SPARE
	15	13	A	14	20	GENERATOR BLOCK HEATER
UV2	15	15	B	16	15	GENERATOR BATTERY CHARGER
	15	17	C	18	15	GENERATOR MISC
SPARE	15	19	A	20	15	SPARE
SPACE		21	B	22		SPACE
SPACE		23	C	24		SPACE

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND AND ABBREVIATION DRAWINGS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.P.GOERTZEN #46152

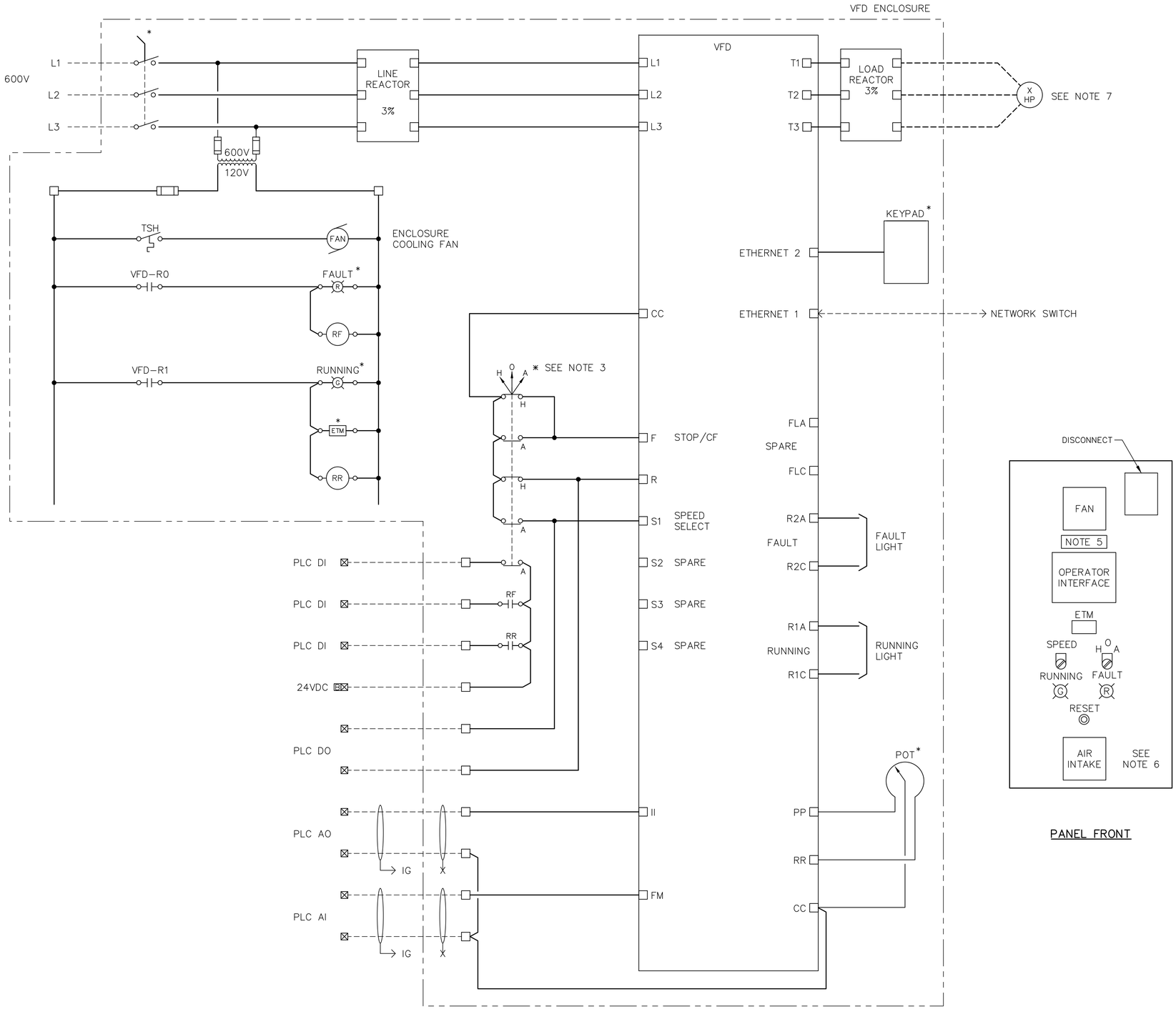
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS
PANEL SCHEDULE

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E12.2



NOTES:

1. ITEMS MARKED WITH ASTERICK (*) ARE TO BE MOUNTED ON DOOR OF ENCLOSURE.
2. DRIVES TO BE CONFIGURED SUCH THAT SPEED REFERENCE IS ETHERNET FROM PLC WHEN HOA IN AUTO AND 0–10V FROM LOCAL POT WHEN HOA IN HAND.
3. LABELED AS:
   HAND–OFF–AUTO.
4. VFD SHOWN IS A TOSHIBA AS3.
5. LAMACOID NAMEPLATE EXAMPLE: P501 VFD
6. AIR INTAKE TO HAVE REPLACEABLE FILTER.
7. REFER TO SINGLE LINE DIAGRAM FOR MOTOR HORSEPOWER.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.P. GOERTZEN # 46152

January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS
TYPICAL VFD MOTOR CONTROL

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E12.3

CABLE SCHEDULE

REF	TAG NUMBER	FROM	TO	CONDUCTOR DETAILS			CONDUIT/CABLE	VOLTAGE	LENGTH	Notes	REV#
		EQUIP TAG	EQUIP TAG	NO.	SIZE AWG	TYPE			(Meters)		
1	G270-PC1	G270	PNL6BDISC	4C	2	R90		600VAC	TBD		
	PNL6B-PC	PNL6BDISC	PNL6B	3C	2	R90		600VAC	TBD		
	VFD102-PC	PNL6B	VFD102	3C	12	R90		600VAC	TBD		
2	WP102-PC	VFD102	WP102	3C	12	R90	TECK	600VAC	TBD		
	VMR171-PC	PNL6B	VMR171	3C	12	R90		600VAC	TBD		
	PNL2BXFMR-PC	PNL6B	PNL2BXFMR	3C	12	R90		600VAC	TBD		
	PNL2B-PC	PNL2BXFMR	PNL2B	3C	10	R90		208VAC	TBD		
	WCP-PC	PNL2B	WCP	6C	12	R90		120VAC	TBD	3 PWR CIRCUITS (UPS,SERVICE RECEPT,CLR192)	
3	G270-PC2	PNL2B	G270	6C	12	R90		120VAC	TBD	3 PWR CIRCUITS (BLOCK HTR, BATT CHRG, MISC)	
	EH193-PC1	PNL2B	EH193	2C	12	R90		120VAC	TBD		
	UV211CP-PC1	PNL2B	UV211CP	2C	12	R90		208VAC	TBD	PWR	
	UV211-PC1	UV211CP	UV211						TBD	PREFABRICATED CABLE C/W UV REACTOR	
	UV212CP-PC1	PNL2B	UV212CP	2C	12	R90		208VAC	TBD	PWR	
	UV212-PC1	UV212CP	UV212						TBD	PREFABRICATED CABLE C/W UV REACTOR	
4	LT102JB-IC	WCP	LT102JB	2PR	18	R90	TECK	24VDC	TBD	1-AI	
	VFD102-IC1	WCP	VFD102	6C	16	R90		24VDC	TBD	3-DI,1-DO	
	VFD102-IC2	WCP	VFD102	2PR	18	R90		24VDC	TBD	1-AI,1-AO	
	FIT122-IC	WCP	FIT122	3PR	18	R90		24VDC	TBD	PWR,1-AI,1-DI	
	VMR171-IC	WCP	VMR171	2C	16	R90		24VDC	TBD	1-DI	
	TT190-IC	WCP	TT190	1PR	18	R90		24VDC	TBD	1-AI	
	TT191-IC	WCP	TT191	1PR	18	R90		24VDC	TBD	1-AI	
	CLR192-IC	WCP	CLR192	2C	12	R90		120VAC	TBD	1-DO	
	EH193-IC	WCP	EH193	2C	16	R90		24VAC	TBD	1-DO	
	FV210-IC	WCP	FV210	2C	16	R90		120VAC	TBD	1-DO	
	AIT210-IP	WCP	AIT210	2C	16	R90		120VAC	TBD	PWR	
	AIT210-IC	WCP	LCP221	1PR	18	R90		24VDC	TBD	1-AI	
	LCP221-IP	WCP	LCP221	2C	16	R90		120VAC	TBD	PWR	
	LCP221-IC	WCP	LCP221	4PR	18	R90		24VDC	TBD	1-AI,1-AO,1-DI,1-DO	
	FV213-IC1	WCP	FV213	3C	16	R90		120VAC	TBD	1-DO	
	FV213-IC2	WCP	FV213	4C	16	R90		24VDC	TBD	3-DI	
	FV214-IC1	WCP	FV214	3C	16	R90		120VAC	TBD	1-DO	
	FV214-IC2	WCP	FV214	4C	16	R90		24VDC	TBD	3-DI	
5	G270-IC	WCP	G270	8C	16	R90		24VDC	TBD	5-DI,1-DO	
	LT270-IC	WCP	LT270	1PR	18	R90		24VDC	TBD	1-AI	
6	BC271-IC	MCP	BC271	2C	16	R90		24VDC	TBD	1-DI	
	VFD102-NET	WCP	VFD102	4PR	24	CAT6		24VDC	TBD	NETWORK	
	UV211-NET	WCP	UV211	4PR	24	CAT6		24VDC	TBD	NETWORK	
	UV212-NET	WCP	UV212	4PR	24	CAT6		24VDC	TBD	NETWORK	
7	G270-NET	WCP	G270	4PR	24	CAT6		24VDC	TBD	NETWORK	

NOTES:
1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. SCHEDULE DOES NOT SHOW ALL CABLES.
3. ALL CABLES TO INCLUDE A GROUND CONDUCTOR.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION



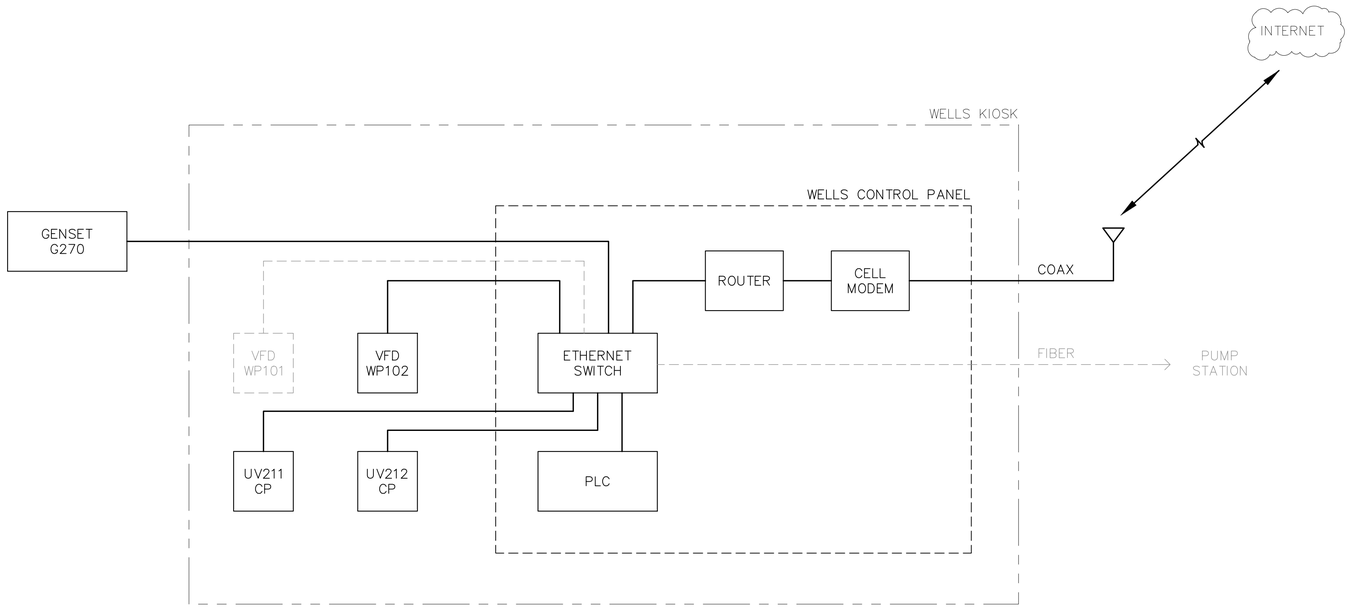
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS
WELLS CABLE SCHEDULE

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E12.4



NOTES:

1. ALL CONNECTIONS CAT6 CABLE UNLESS OTHERWISE SPECIFIED.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
#48152

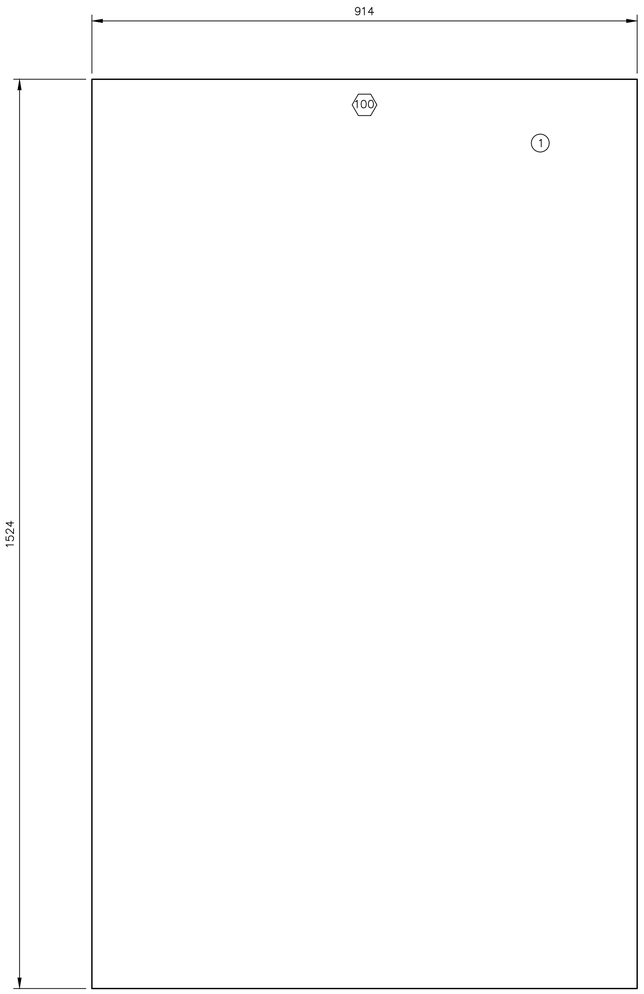
January 22, 2021

MPE Engineering Ltd.

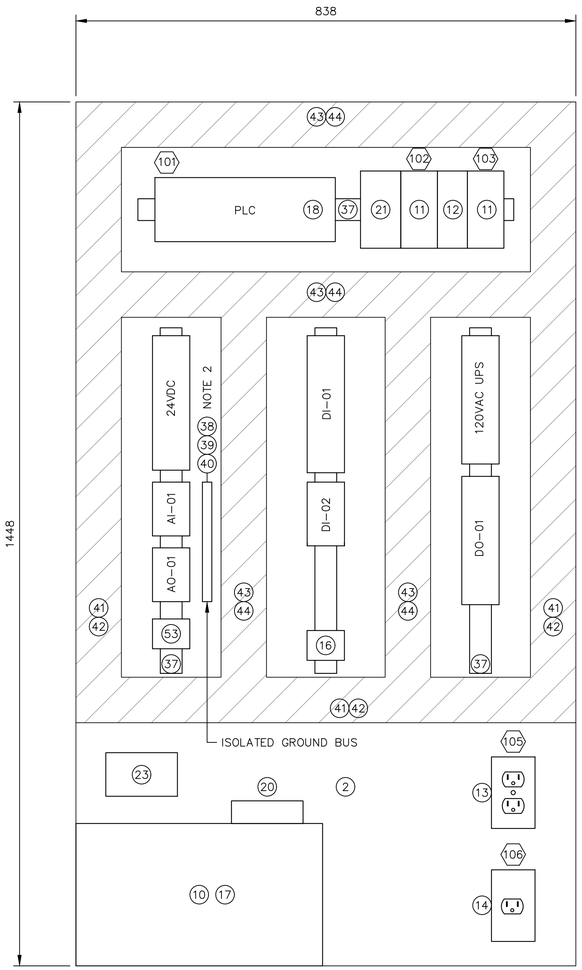
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS CONTROL ARCHITECTURE

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.1



CONTROL PANEL EXTERIOR



CONTROL PANEL INTERIOR

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ISOLATED GROUND BUS TO BE CONNECTED TO GROUND GRID.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.P. GOERTZEN #48152

January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS CONTROL PANEL LAYOUT

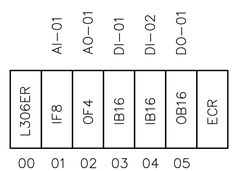
DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.2

BILL OF MATERIALS

ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No.	
1	1	ENCLOSURE – SINGLE DOOR 60"x36"x12" C/W 3 POINT LATCH	HOFFMAN	A60H36DLP3PT	
2	1	ENCLOSURE – BACK MOUNTING PLATE	HOFFMAN	A60P36	
3					
4					
5					
6					
7					
8					
9	2	UPS BATTERY BANK	ALWAYS ON	BBU152B	NOTE 5
10	1	UPS 1500 VA/120VAC SIDE MOUNTING DISPLAY	ALWAYS ON	GES152N WITH OPTIONS	NOTE 2
11	2	POWER SUPPLY 24VDC 5A	PHOENIX CONTACT	2903148	
12	1	DIODE MODULE	PHOENIX CONTACT	2907380	
13	1	DUPLEX RECEPTACLE (ORANGE)			
14	1	SIMPLEX RECEPTACLE			
15					
16	1	DB25 TO TERMINALS INTERFACE	PHOENIX CONTACT	2315188	
17	1	DB25 SOCKET TO DB25 PIN CABLE LENGTH AS APPROPRIATE			
18	1	PLC	ROCKWELL	SEE LAYOUT	
19					
20	1	ROUTER	CISCO	MERAKI Z3 C/W 5 YEAR ENTERPRISE SUPPORT	
21	1	ETHERNET SWITCH 8 PORTS. 7 CU AND 1 MULTIMODE FIBER	ROCKWELL	1783–US7T1F	
22	A/R	ANTENNA CABLE LMR400 N MALE CONNECTORS. LENGTH AS REQUIRED			
23	1	CELL MODEM C/W MOUNTING BRACKET AND POWER CABLE	MICROHARD	MHS117404, MHS050030, MHS041420	
24	1	CELL ANTENNA C/W PERMANENT MOUNT AND MAST MOUNT	MICROHARD	MHS035420, MHS035520, MHS035530	NOTE 4
25	1	CELL ANTENNA LIGHTING PROTECTION AND CABLE JUMPER (MODEM TO LPU)	MICROHARD	MHS042030, MHS040730	
26	A/R	ELECTRONIC CIRCUIT BREAKER 24VDC 1–3A	PHOENIX CONTACT	2909909	
27					
28	A/R	THERMAL MAGNETIC CIRCUIT BREAKER 120VAC 2A TMC 81C02A	PHOENIX CONTACT	2907559	
29	A/R	KNIFE DISCONNECT TERMINAL BLOCK – PT4–MT	PHOENIX CONTACT	3211933	
30	A/R	TERMINAL, PT4	PHOENIX CONTACT	3211757	
31	A/R	FUSE TERMINAL, PT4, VOLTAGE AS REQUIRED	PHOENIX CONTACT		
32	A/R	RELAY TERMINAL, 24VDC ICO, 10A CONTACTS	PHOENIX CONTACT	2967620	
33	A/R	GROUND TERMINAL PT4–PE	PHOENIX CONTACT	3044128	
34	A/R	END BRACKET, CLIP FIX 35–5	PHOENIX CONTACT	3211776	
35	A/R	END PLATE, DU–T	PHOENIX CONTACT	3047028	
36	A/R	TAG CARRIER, KLM 3–L	PHOENIX CONTACT	0814788	
37	A/R	MOUNTING RAIL	PHOENIX CONTACT		
38	1	BUS BAR, PERFORATED, NSCH 15x2	WEIDMULLER		
39	A/R	PRESSURE PIECE, DKSUE	WEIDMULLER		
40	A/R	CLAMPING SCREW, BFSC M5x8	WEIDMULLER		
41	A/R	2" X 3" NARROW FINGER SLOTTED WIRING DUCT, WHITE	PANDUIT	F2X3WH6	
42	A/R	2" WIRING DUCT COVER, WHITE	PANDUIT	C2WH6	
43	A/R	3" X 3" NARROW FINGER SLOTTED WIRING DUCT, WHITE	PANDUIT	F3X3WH6	
44	A/R	3" WIRING DUCT COVER, WHITE	PANDUIT	C3WH6	
45	A/R	4" X 3" NARROW FINGER SLOTTED WIRING DUCT, WHITE	PANDUIT	F4X3WH6	
46	A/R	4" WIRING DUCT COVER, WHITE	PANDUIT	C4WH6	
47	A/R	4" WIRING DUCT COVER, WHITE	PANDUIT	C4WH6	
48					
49	A/R	RELAY PLUG–IN BRIDGE BLUE	PHOENIX CONTACT	2966692	
50	A/R	TERMINAL JUMPER 2 POSITION RED	PHOENIX CONTACT	3030336	
51	A/R	TERMINAL JUMPER No. POSITION AND COLOUR AS NEEDED	PHOENIX CONTACT		
52					
53	2	LIGHTNING SURGE PROTECTION 1x4–20mA SIGNAL	PHOENIX CONTACT	2906750	NOTE 3
54					
55					
56					
57					
58					
59					
60					
61					
62					

LAMICOID/LABEL SCHEDULE

ITEM	QTY	DESCRIPTION	TYPE	SIZE
100		CONTROL PANEL	LAMICOID	25x50
101		PLC RACK 0	LAMICOID	25x50
102		POWER SUPPLY A	LAMICOID	25x50
103		POWER SUPPLY B	LAMICOID	25x50
104				
105		UPS RECEPTACLE	LAMICOID	25x50
106		UPS FEED	LAMICOID	25x50
107				
108				
109				
110				
111				
112				
150				
151		120VAC UPS	LABEL	TO FIT
152		24 VDC	LABEL	TO FIT
153		DI–01	LABEL	TO FIT
154		DI–02	LABEL	TO FIT
155		DO–01	LABEL	TO FIT
156		AI–01	LABEL	TO FIT
157		AO–01	LABEL	TO FIT
158				
159				



PLC LAYOUT

5069–L306ER	COMPACT LOGIX PROGRAMMABLE LOGIC CONTROLLER
5069–IF8	COMPACT LOGIX ANALOG INPUT (8)
5069–OF4	COMPACT LOGIX ANALOG OUTPUT (4)
5069–IB16	COMPACT LOGIX DISCRETE DC INPUT (16) 24VDC
5069–OB16	COMPACT LOGIX DISCRETE DC OUTPUT (16) 24VDC
5069–ECR	COMPACT LOGIX END CAP

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND AND ABBREVIATION DRAWINGS.
2. UPS WITH DISPLAY SIDE MOUNTED.
   - 2.1. 30300 (GES–152N 120V)
   - 2.2. 00987 (AS400 RELAY COMMUNICATION CARD)
   - 2.3. 30080 (FACE PLATE SIDE MOUNT OPTION 701N–152N)
3. SECOND LIGHTNING SURGE PROTECTION UNIT TO BE INSTALLED IN WELL SIGNAL JUNCTION BOX.
4. MOUNT ON MAST AS SHOWN ON KIOSK DRAWINGS.
5. BATTERY BANKS INSTALLED IN KIOSK ELECTRICAL SECTION. PROVIDE CABLING TO CONNECT BATTERY BANKS TO UPS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY–MM–DD	REVISION
1	21–01–22	FOR TENDER



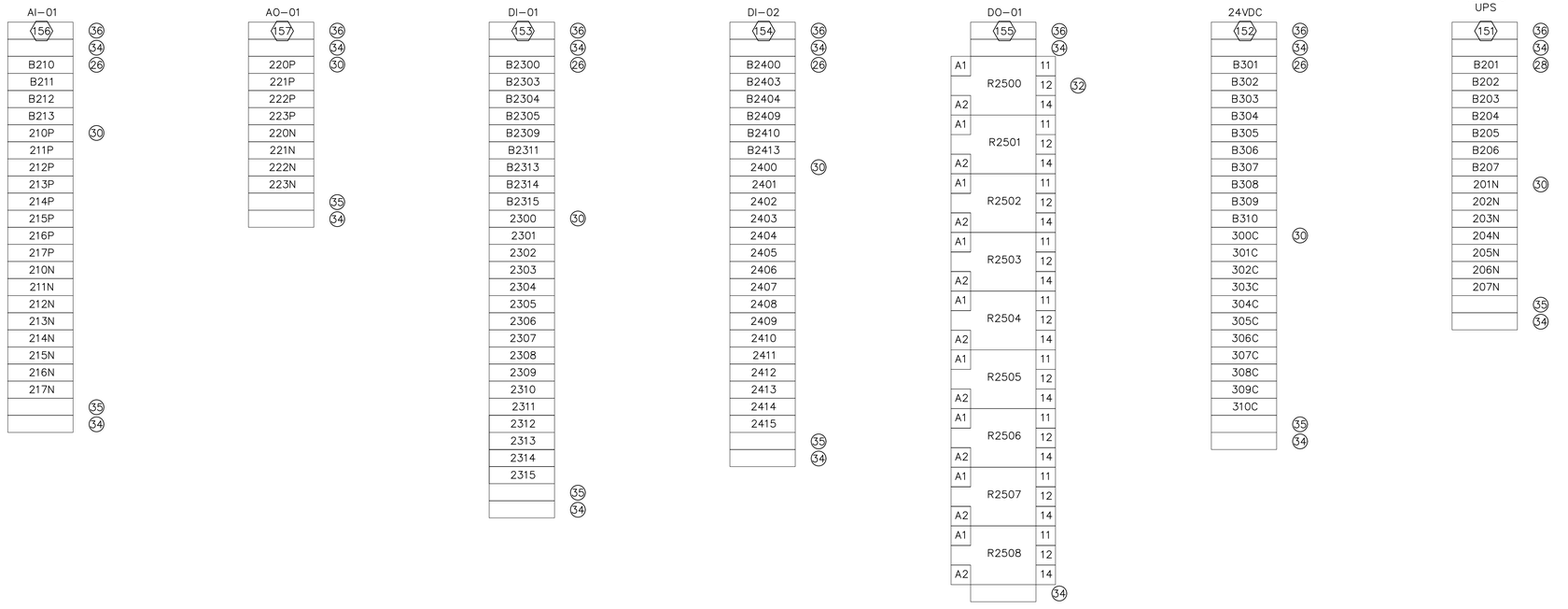
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS CONTROL PANEL BILL OF MATERIALS & LABEL SCHEDULE

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.3



24VDC CIRCUIT BREAKER DETAIL

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND AND ABBREVIATION DRAWINGS.
2. ADJACENT JUMPERED TERMINALS TO BE IMPLEMENTED WITH MANUFACTURER PROVIDED BRIDGES.
3. 24VDC CIRCUIT BREAKERS TO BE SUPPLIED WITH BOTH 24VDC+ AND 24VDC COM. CIRCUIT BREAKERS FOR 24VDC AND DIGITAL INPUT TERMINAL STRIPS TO BE MONITORED BY PLC INPUTS. MONITORING CONTACTS OF EACH GROUP INDICATED TO BE CONNECTED IN SERIES WITH MANUFACTURER 2 POLE BRIDGES. SEE DETAIL.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P.GOERTZEN
#46152

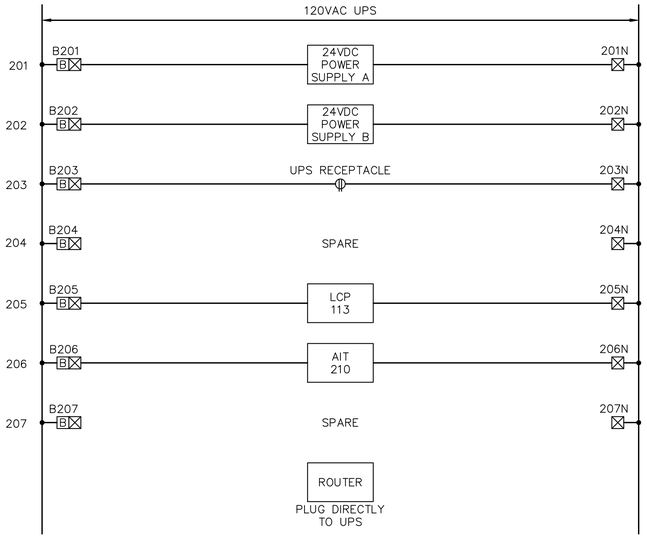
January 22, 2021

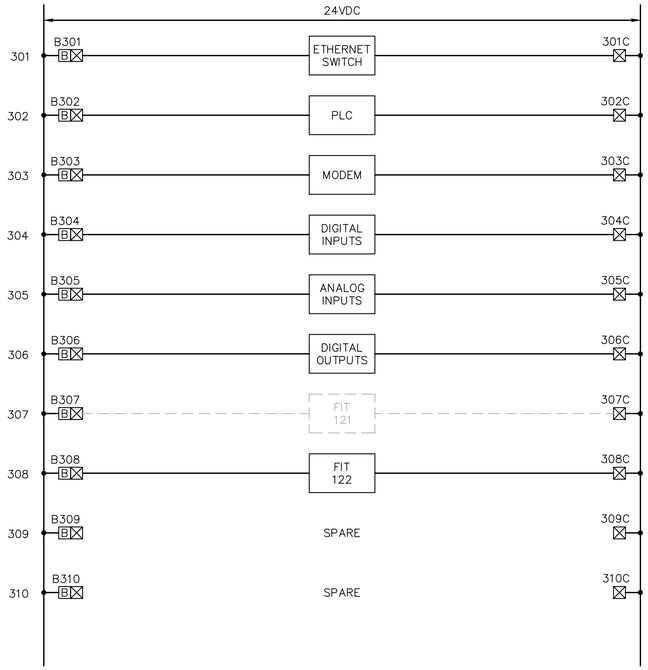
MPE Engineering Ltd.

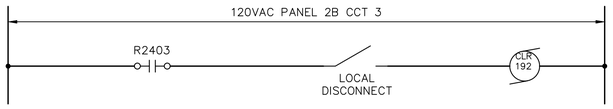
REGIONAL DISTRICT OF NANAIMO

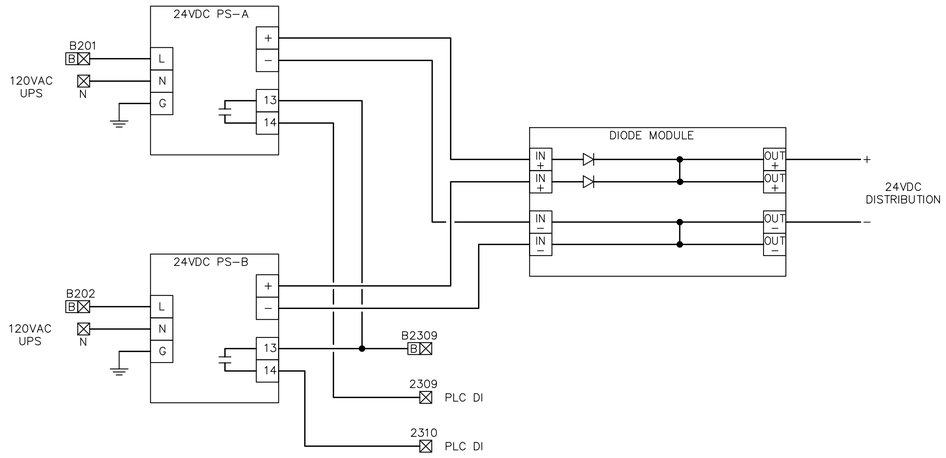
WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS CONTROL PANEL TERMINAL STRIP LAYOUT

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.4









POWER SUPPLY SCHEMATIC

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND AND ABBREVIATION DRAWINGS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
46152

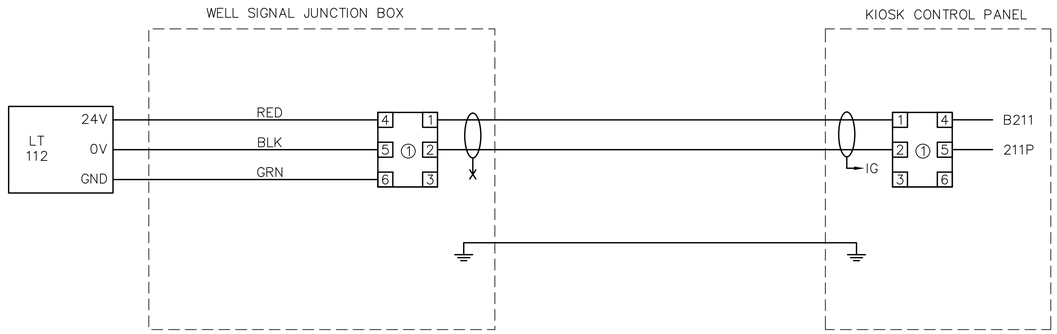
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS CONTROL PANEL
POWER DISTRIBUTION

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.5



ITEM	DESCRIPTION	MANUFACTURER	MODEL
①	SURGE PROTECTION DEVICE 4–20mA	PHOENIX CONTACT	2906750

NOTES:

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY–MM–DD	REVISION
1	21–01–22	FOR TENDER

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
46152

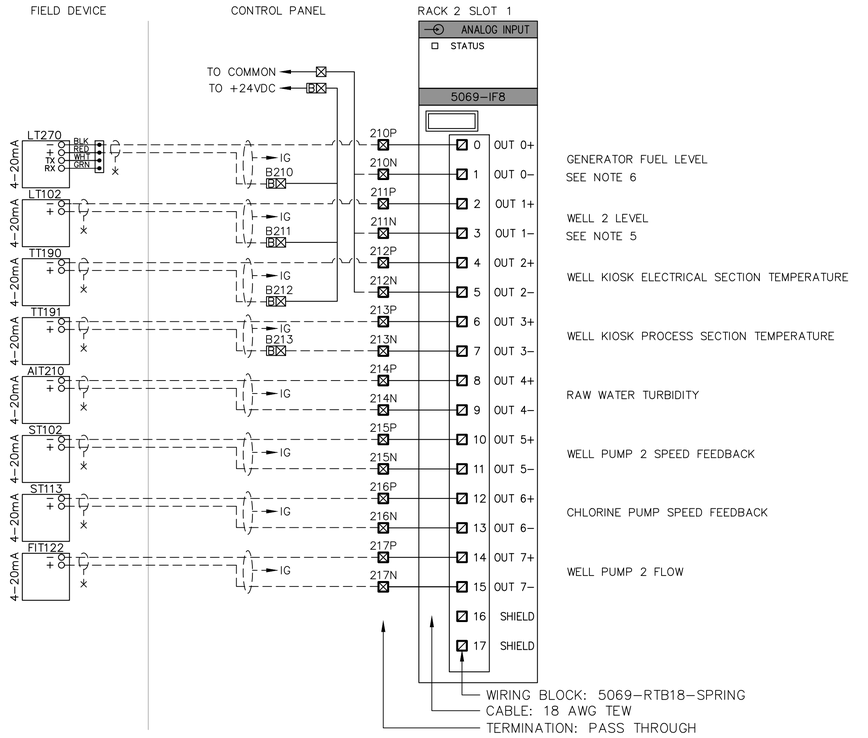
January 22, 2021

MPE Engineering Ltd.

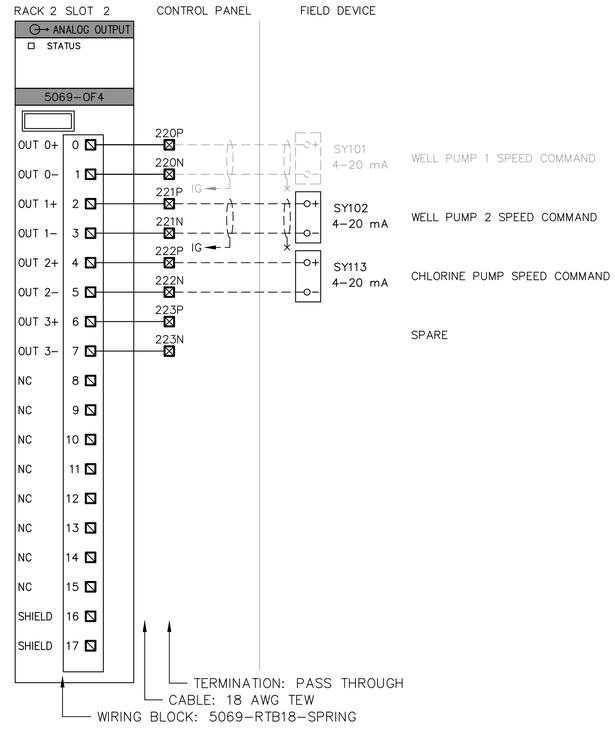
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS
SIGNAL WIRING DIAGRAM

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.6



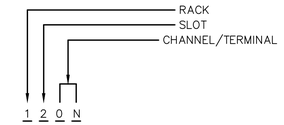
AI–01



AO–01

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. REFER TO BILL OF MATERIALS AND LABEL SCHEDULE DRAWING.
3. REFER TO CONTROL PANEL ENCLOSURE DRAWING FOR TERMINAL STRIP LOCATION.
4. CIRCUIT BREAKERS 1AMP UNLESS NOTED OTHERWISE.
5. SEE WELLS SIGNAL WIRING DIAGRAM.
6. PREFABRICATED CABLE ON DEVICE TO BE TERMINATED IN LOCAL JUNCTION BOX. TX AND RX USED FOR CONFIGURATION FOB CONNECTION.



THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION



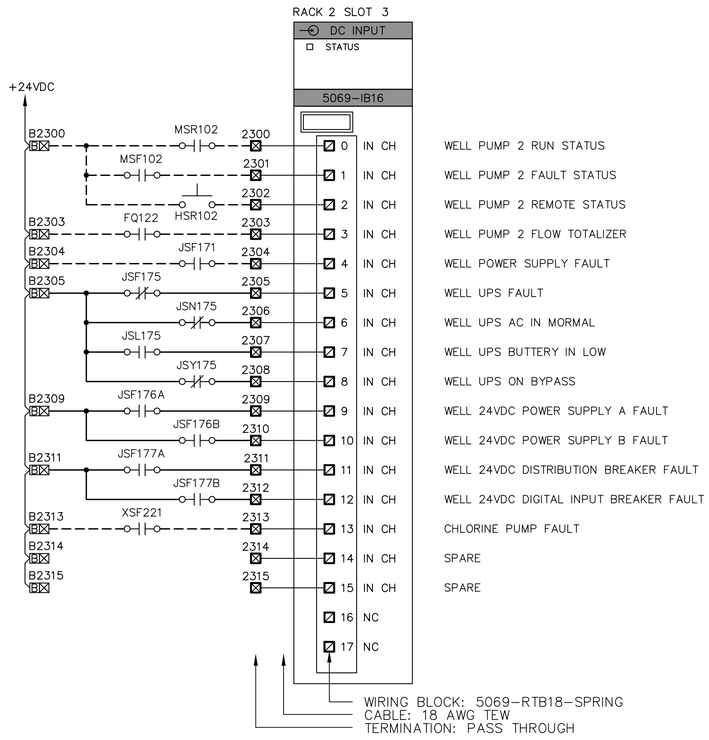
January 22, 2021

MPE Engineering Ltd.

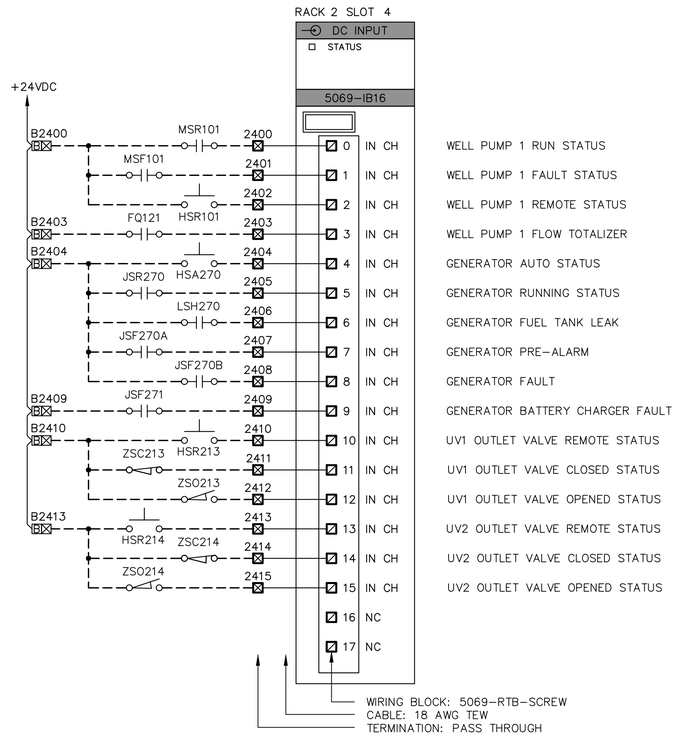
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS PLC ANALOG INPUT /OUTPUT MODULES

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.11



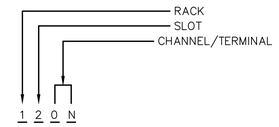
DI-01



DI-02

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. REFER TO BILL OF MATERIALS AND LABEL SCHEDULE DRAWING.
3. REFER TO CONTROL PANEL ENCLOSURE DRAWING FOR TERMINAL STRIP LOCATION.
4. CIRCUIT BREAKERS 1AMP UNLESS NOTED OTHERWISE.



THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER



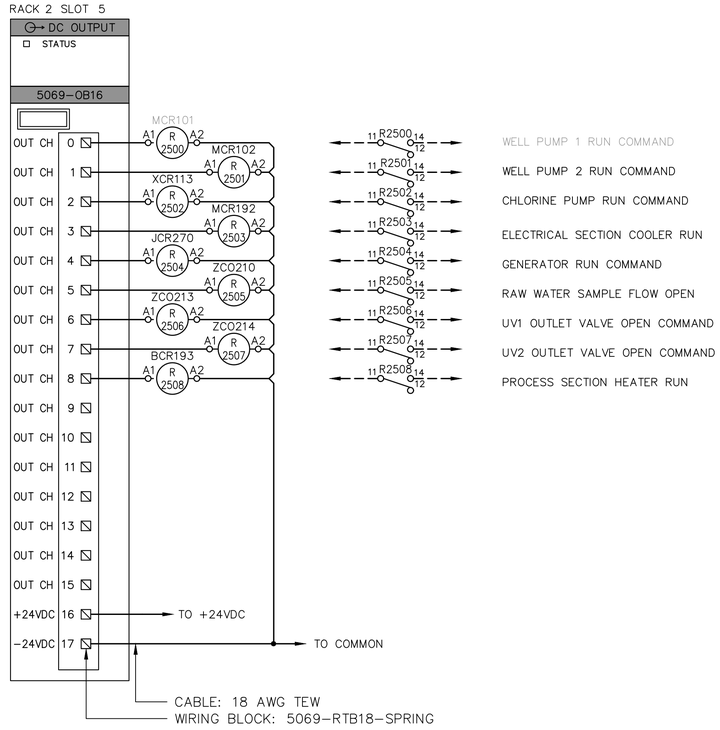
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS PLC DIGITAL INPUT MODULES 1 AND 2

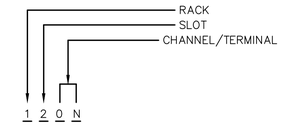
DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.12



DO-01

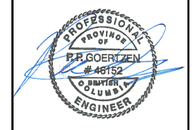
NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. REFER TO BILL OF MATERIALS AND LABEL SCHEDULE DRAWING.
3. REFER TO CONTROL PANEL ENCLOSURE DRAWING FOR TERMINAL STRIP LOCATION.
4. CIRCUIT BREAKERS 1AMP UNLESS NOTED OTHERWISE.



THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION



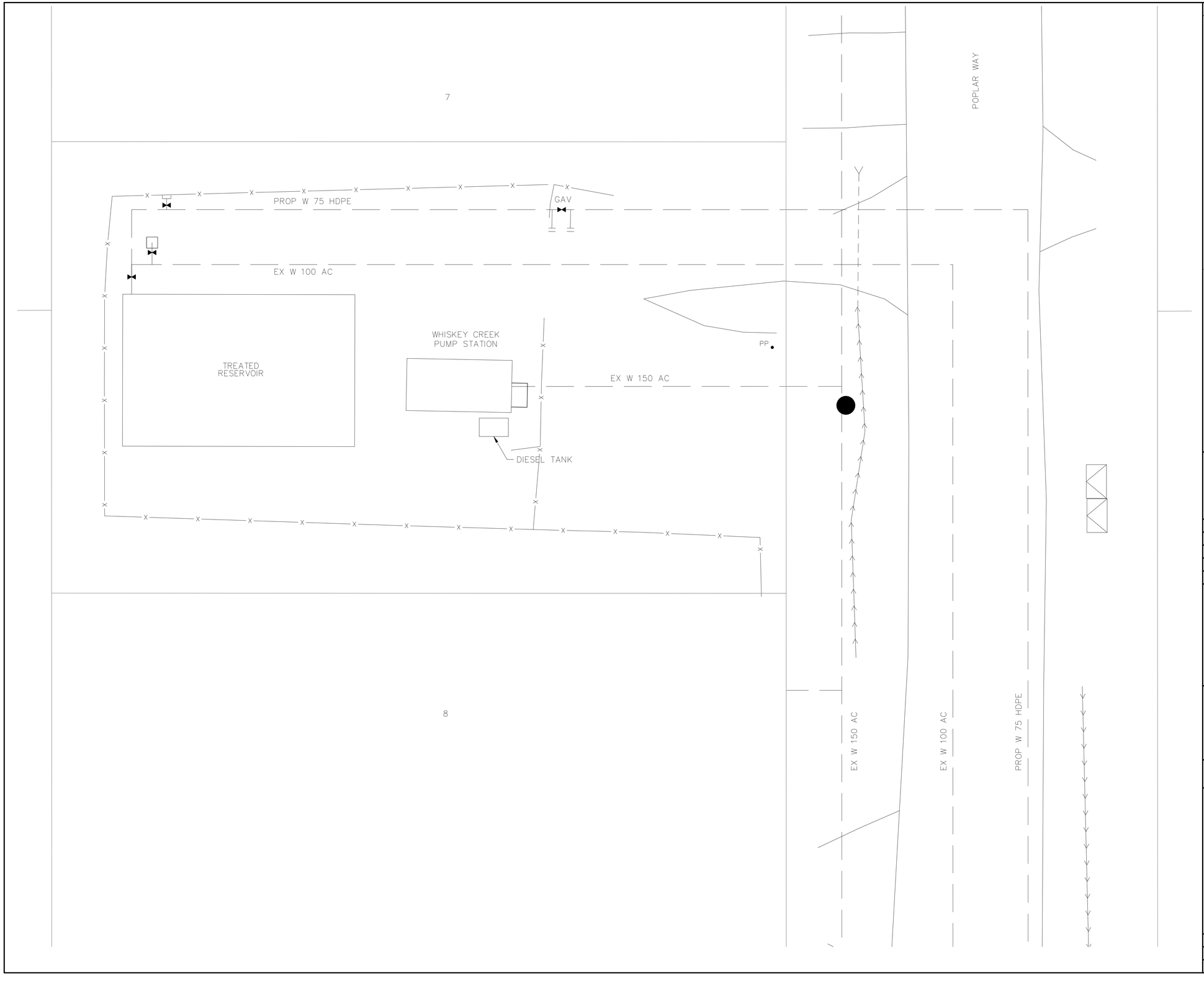
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
WELLS PLC DIGITAL OUTPUT
MODULE 1

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E13.13



PROPOSED	LEGEND	EXISTING
	DRAINAGE DITCH	
	FENCE	
	EDGE OF PAVEMENT	
	EDGE OF GRAVEL	
	BURIED POWER	
	MAILBOX	
	POWER POLE	PP
	CULVERT	
	WATER WELL	
	STANDPIPE	
PROP W 75 HDPE	WATER MAIN	EX W CL 150 AC
	WATER VALVE	
	WATER HYDRANT	

NOTES:
1. ALL PIPE SIZES ARE IN MILLIMETRES AND ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL BOLD ITEMS INDICATE WORK TO BE DONE AND ALL LIGHT ITEMS INDICATE EXISTING CONDITIONS.

FOR INFORMATION ONLY

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER

P.P. GOERTZEN #48152 PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA

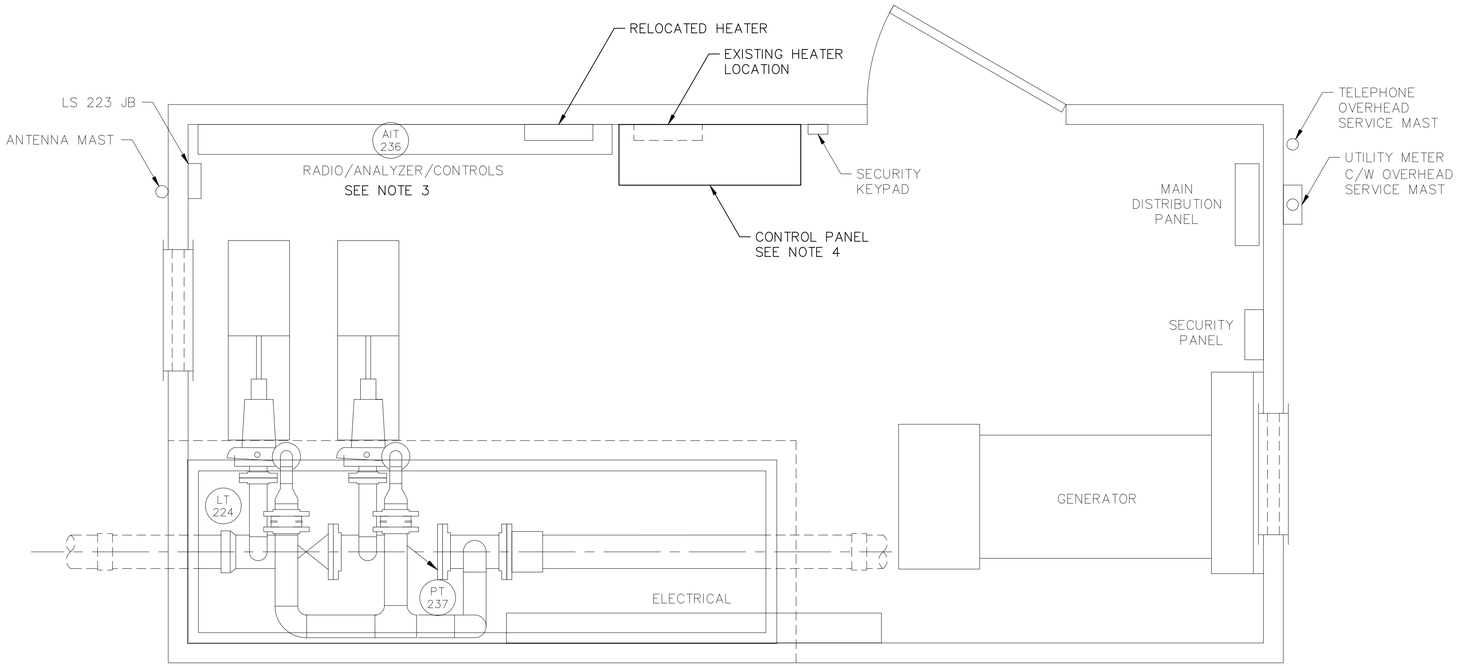
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
RESERVOIR AND PUMP STATION
SITE PLAN

DESIGNED	J.M.H.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:100
DATE	JANUARY 2021	DRAWING	E21.1



FUEL TANK

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND DRAWING.
2. ALL PROPOSED ITEMS ARE SHOWN IN DARK BOLD WITH ALL EXISTING IN LIGHT AND FUTURE IN LIGHT DASHED.
3. REMOVE CHART RECORDER AND ASSOCIATED WIRING. RADIO COMMUNICATIONS TO EXISTING INTAKE TO REMAIN IN SERVICE.
4. RELOCATE BUILDING HEATER AND THERMOSTAT TO MAKE ROOM FOR CONTROL PANEL. PANEL LOCATION IS INTERIM TILL FUTURE PUMP STATION UPGRADES.
5. EXISTING PROCESS INSTRUMENTATIONS TO BE WIRED INTO NEW CONTROL PANEL AS SHOWN ON CABLE SCHEDULE AND PLC WIRING DRAWINGS. EXISTING CONTROLS TO REMAIN FUNCTIONAL.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P. GOERTZEN
46152

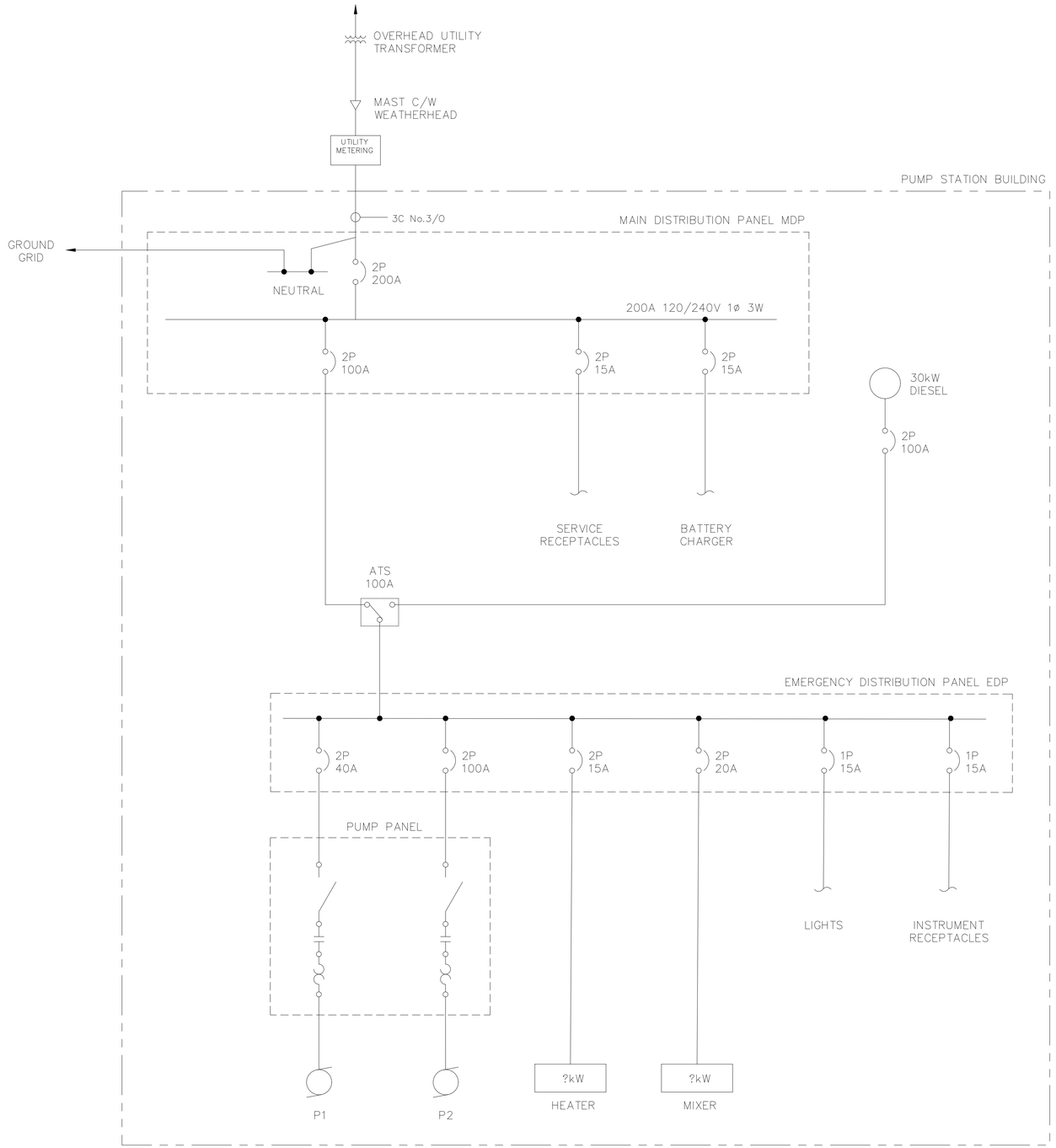
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION
EQUIPMENT LAYOUT

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	1:15
DATE	JANUARY 2021	DRAWING	E21.2



NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS AND SYMBOLS REFER TO THE LEGEND DRAWINGS.

FOR INFORMATION ONLY

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.P. GOERTZEN #48152

January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION SINGLE LINE DIAGRAM

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E22.1

CABLE SCHEDULE											
REF	TAG NUMBER	FROM	TO	CONDUCTOR DETAILS			CONDUIT/CABLE	VOLTAGE	LENGTH	Notes	REV#
		EQUIP TAG	EQUIP TAG	NO.	SIZE AWG	TYPE			(Meters)		
	MCP-PC	EDP	MCP	4C	12	R90		120VAC	TBD	2 PWR CIRCUITS	
	AIT236-IP	MCP	AIT236	2C	16	R90		120VAC	TBD	PWR	
	AIT236-IC	MCP	AIT236	1PR	18	R90		24VDC	TBD	1-AI	
	LT224-IC	MCP	LT222	1PR	18	R90		24VDC	TBD	1-AI	
	PT237-IC	MCP	PT237	1PR	18	R90		24VDC	TBD	1-AI	
	PUMPCTRL-IC	MCP	PUMPCTRL	1PR	18	R90		24VDC	TBD	PT237 LOOP THROUGH	
	LS223JBIC	MCP	LS223JB	4C	16	R90		24VDC	TBD	2-DI	
	ISP-NET	MCP	ISP			COAX				INTERNET SERVICE PROVIDER	

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. SCHEDULE DOES NOT SHOW ALL CABLES.
3. ALL CABLES TO INCLUDE A GROUND CONDUCTOR.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.R. GOERTZEN #48152

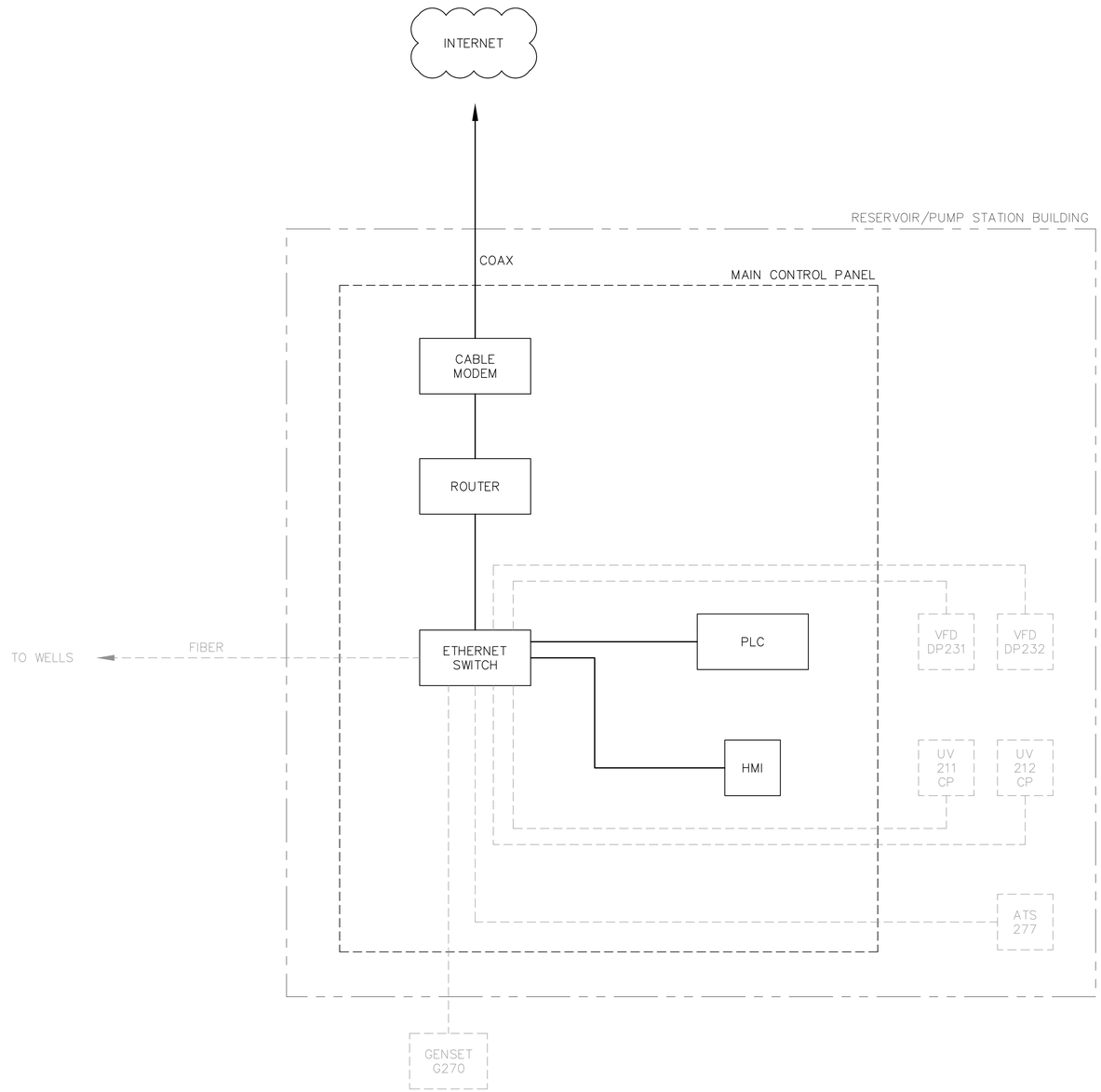
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION CABLE SCHEDULE

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E22.4



NOTES:

1. ALL CONNECTIONS CAT6 CABLE UNLESS OTHERWISE SPECIFIED.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.P. GOERTZEN #46152

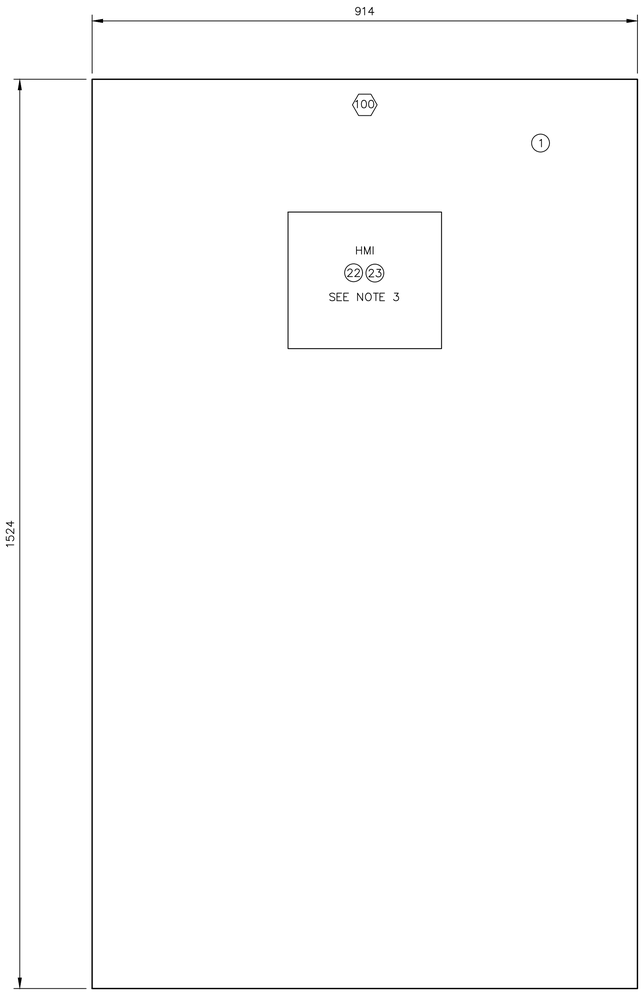
January 22, 2021

MPE Engineering Ltd.

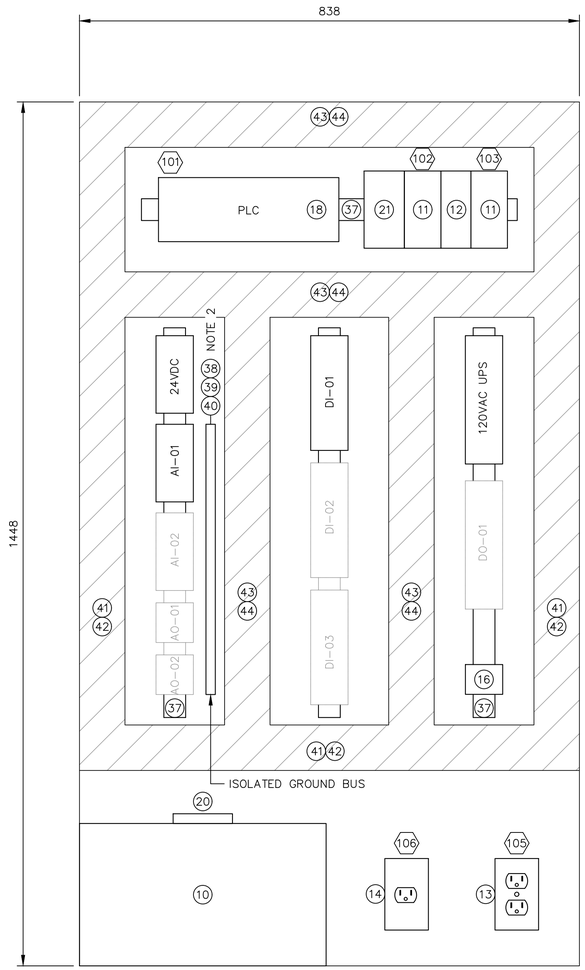
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION CONTROL
ARCHITECTURE

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E23.1



CONTROL PANEL EXTERIOR



CONTROL PANEL INTERIOR

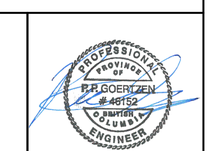
PLC LAYOUT

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ISOLATED GROUND BUS TO BE CONNECTED TO GROUND GRID.
3. CENTRE OF OPERATOR INTERFACE TO BE 1500AFF.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	21-01-22	FOR TENDER



January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION CONTROL PANEL
LAYOUT

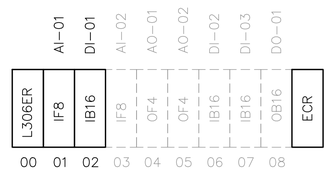
DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E23.2

BILL OF MATERIALS

ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No.	
1	1	ENCLOSURE – SINGLE DOOR 60"x36"x12" C/W 3 POINT LATCH	HOFFMAN	A60H36DLP3PT	
2	1	ENCLOSURE – BACK MOUNTING PLATE	HOFFMAN	A60P36	
3					
4					
5					
6					
7					
8					
9					
10	1	UPS 1500 VA/120VAC SIDE MOUNTING DISPLAY	ALWAYS ON	GES152N WITH OPTIONS	NOTE 2
11	2	POWER SUPPLY 24VDC 5A	PHOENIX CONTACT	2903148	
12	1	DIODE MODULE	PHOENIX CONTACT	2907380	
13	1	DUPLEX RECEPTACLE (ORANGE)			
14	1	SIMPLEX RECEPTACLE			
15					
16	1	DB25 TO TERMINALS INTERFACE	PHOENIX CONTACT	2315188	
17	1	DB25 SOCKET TO DB25 PIN CABLE LENGTH AS APPROPRIATE			
18	1	PLC	ROCKWELL	SEE LAYOUT	
19					
20	1	ROUTER	CISCO	MERAKI Z3 C/W 5 YEAR ENTERPRISE SUPPORT	
21	1	ETHERNET SWITCH 18 PORTS. 16 CU / 1 MULTIMODE FIBER	ROCKWELL	1783–US16T2S, 1783–SFP100FX	
22	1	HMI PANELVIEW PLUS 12" WIDESCREEN	ROCKWELL	2711P–T12W22D9P	
23	1	HMI MEMORY CARD 2GB	ROCKWELL	1784–SD2	
24					
25					
26	A/R	ELECTRONIC CIRCUIT BREAKER 24VDC 1–3A	PHOENIX CONTACT	2909909	
27					
28	A/R	THERMAL MAGNETIC CIRCUIT BREAKER 120VAC 2A TMC 81C02A	PHOENIX CONTACT	2907559	
29					
30	A/R	TERMINAL, PT4	PHOENIX CONTACT	3211757	
31					
32					
33	A/R	GROUND TERMINAL PT4–PE	PHOENIX CONTACT	3044128	
34	A/R	END BRACKET, CLIP FIX 35–5	PHOENIX CONTACT	3211776	
35	A/R	END PLATE, DU–T	PHOENIX CONTACT	3047028	
36	A/R	TAG CARRIER, KLM 3–L	PHOENIX CONTACT	0814788	
37	A/R	MOUNTING RAIL	PHOENIX CONTACT		
38	1	BUS BAR, PERFORATED, NSCH 15x2	WEIDMULLER		
39	A/R	PRESSURE PIECE, DKSUE	WEIDMULLER		
40	A/R	CLAMPING SCREW, BFSC M5x8	WEIDMULLER		
41	A/R	2" X 3" NARROW FINGER SLOTTED WIRING DUCT, WHITE	PANDUIT	F2X3WH6	
42	A/R	2" WIRING DUCT COVER, WHITE	PANDUIT	C2WH6	
43	A/R	3" X 3" NARROW FINGER SLOTTED WIRING DUCT, WHITE	PANDUIT	F3X3WH6	
44	A/R	3" WIRING DUCT COVER, WHITE	PANDUIT	C3WH6	
45	A/R	4" X 3" NARROW FINGER SLOTTED WIRING DUCT, WHITE	PANDUIT	F4X3WH6	
46	A/R	4" WIRING DUCT COVER, WHITE	PANDUIT	C4WH6	
47					
48					
49					
50	A/R	TERMINAL JUMPER 2 POSITION RED	PHOENIX CONTACT	3030336	
51	A/R	TERMINAL JUMPER No. POSITION AND COLOUR AS NEEDED	PHOENIX CONTACT		
52					
53					
54					
55					
56					
57					
58					
59					
60					
61					
62					

LAMICOID/LABEL SCHEDULE

ITEM	QTY	DESCRIPTION	TYPE	SIZE
100		CONTROL PANEL	LAMICOID	25x50
101		PLC RACK 0	LAMICOID	25x50
102		POWER SUPPLY A	LAMICOID	25x50
103		POWER SUPPLY B	LAMICOID	25x50
104				
105		UPS RECEPTACLE	LAMICOID	25x50
106		UPS FEED	LAMICOID	25x50
107				
108				
109				
110				
111				
112				
150				
151		120VAC UPS	LABEL	TO FIT
152		24 VDC	LABEL	TO FIT
153		DI–01	LABEL	TO FIT
154				
155				
156				
157		AI–01	LABEL	TO FIT
158				
159				



PLC LAYOUT

5069–L306ER	COMPACT LOGIX PROGRAMMABLE LOGIC CONTROLLER
5069–IF8	COMPACT LOGIX ANALOG INPUT (8)
5069–IB16	COMPACT LOGIX DISCRETE DC INPUT (16) 24VDC
5069–OF4	COMPACT LOGIX ANALOG OUTPUT (4)
5069–OB16	COMPACT LOGIX DISCRETE DC OUTPUT (16) 24VDC
5069–ECR	COMPACT LOGIX END CAP

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND AND ABBREVIATION DRAWINGS.
2. UPS WITH DISPLAY SIDE MOUNTED.
   - 2.1. 30300 (GES–152N 120V)
   - 2.2. 00987 (AS400 RELAY COMMUNICATION CARD)
   - 2.3. 30080 (FACE PLATE SIDE MOUNT OPTION 701N–152N)

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY–MM–DD	REVISION
1	21–01–22	FOR TENDER



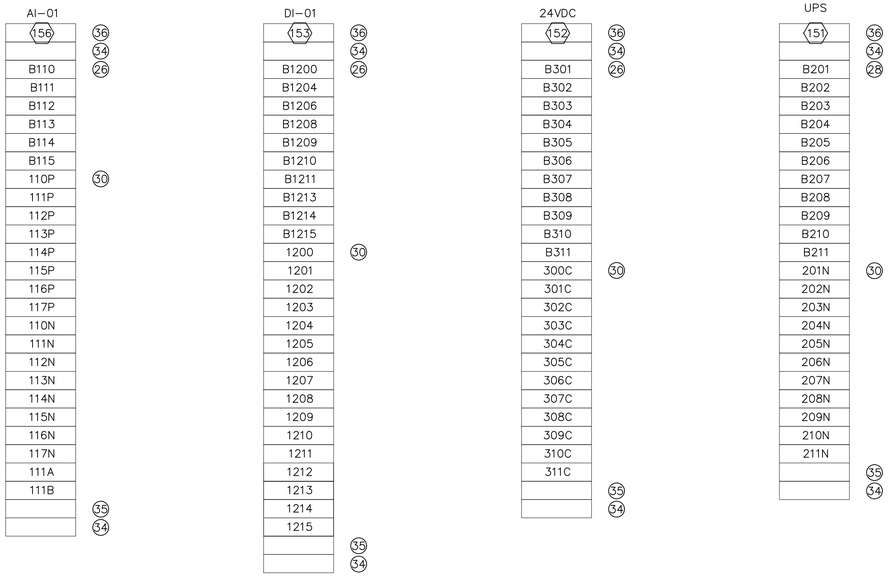
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

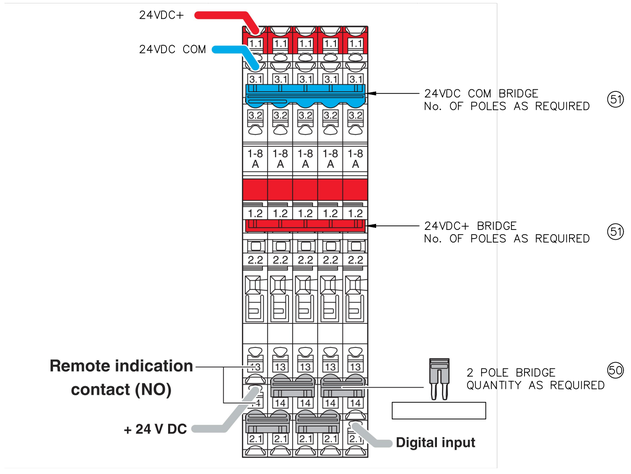
WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION CONTROL PANEL
BILL OF MATERIALS & LABEL SCHEDULE

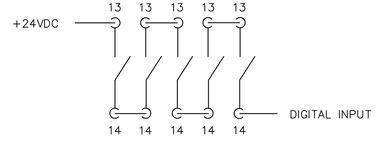
DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E23.3



NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND AND ABBREVIATION DRAWINGS.
2. ADJACENT JUMPERED TERMINALS TO BE IMPLEMENTED WITH MANUFACTURER PROVIDED BRIDGES.
3. 24VDC CIRCUIT BREAKERS TO BE SUPPLIED WITH BOTH 24VDC+ AND 24VDC COM. CIRCUIT BREAKERS FOR 24VDC AND DIGITAL INPUT TERMINAL STRIPS TO BE MONITORED BY PLC INPUTS. MONITORING CONTACTS OF EACH GROUP INDICATED TO BE CONNECTED IN SERIES WITH MANUFACTURER 2 POLE BRIDGES. SEE DETAIL.





24VDC CIRCUIT BREAKER DETAIL

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY–MM–DD	REVISION
1	21–01–22	FOR TENDER

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P.P.GOERTZEN
#46152

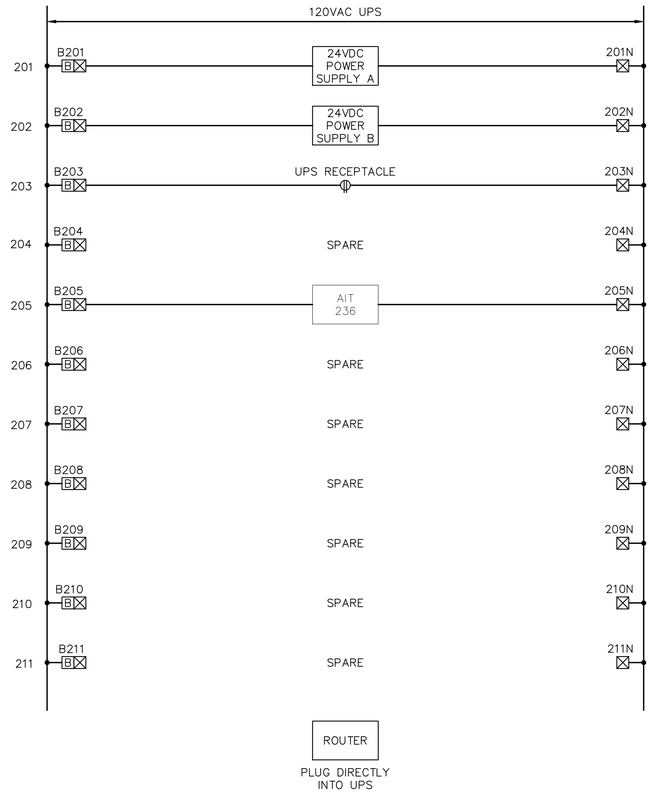
January 22, 2021

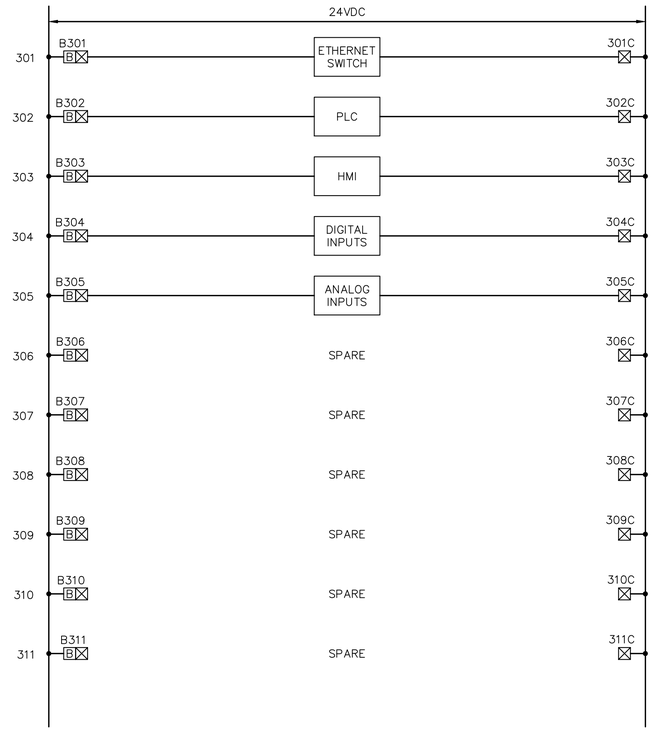
MPE Engineering Ltd.

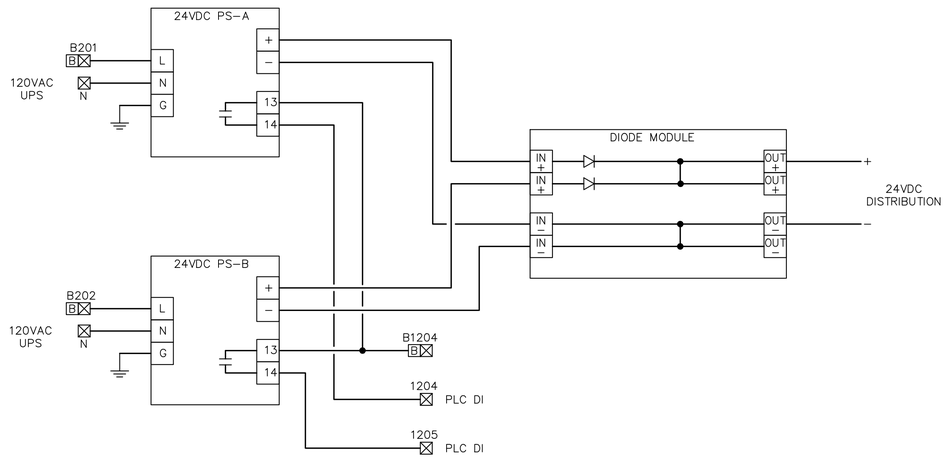
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION CONTROL PANEL
TERMINAL STRIP LAYOUT

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E23.4







POWER SUPPLY SCHEMATIC

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, UTILITIES, AND SYMBOLS, REFER TO THE LEGEND AND ABBREVIATION DRAWINGS.

THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA P.P. GOERTZEN #48152

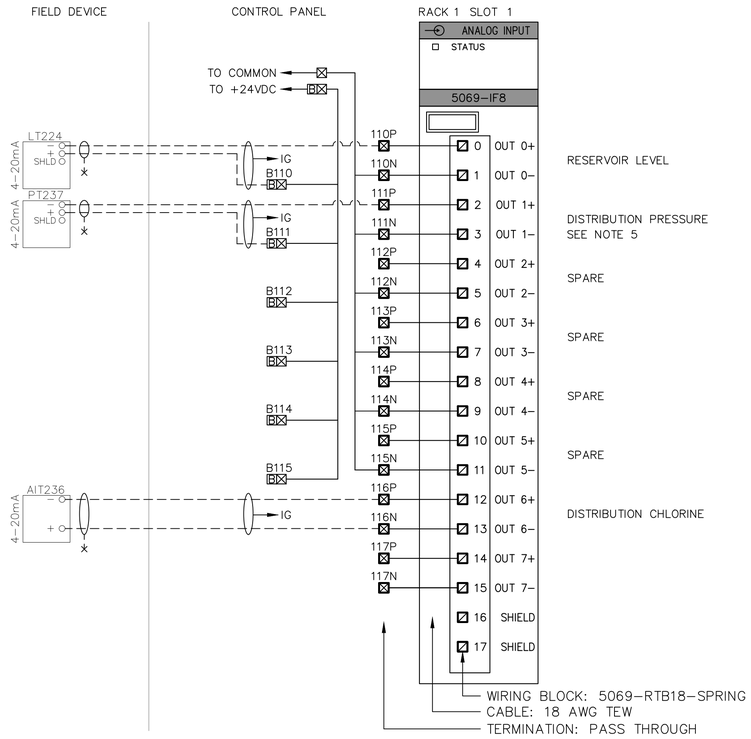
January 22, 2021

MPE Engineering Ltd.

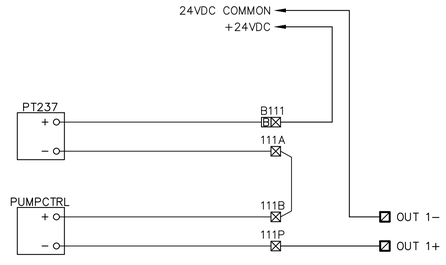
REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION CONTROL PANEL
POWER DISTRIBUTION

DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E23.5



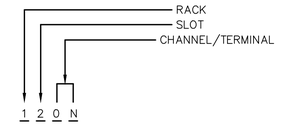
AI–01



PT237 LOOP DIAGRAM

NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. REFER TO BILL OF MATERIALS AND LABEL SCHEDULE DRAWING.
3. REFER TO CONTROL PANEL ENCLOSURE DRAWING FOR TERMINAL STRIP LOCATION.
4. CIRCUIT BREAKERS 1AMP UNLESS NOTED OTHERWISE.
5. SIGNAL TO LOOP THROUGH EXISTING PUMP CONTROLLER. SEE PT237 LOOP DIAGRAM.



THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21–01–22	FOR TENDER
ISSUE	YY–MM–DD	REVISION



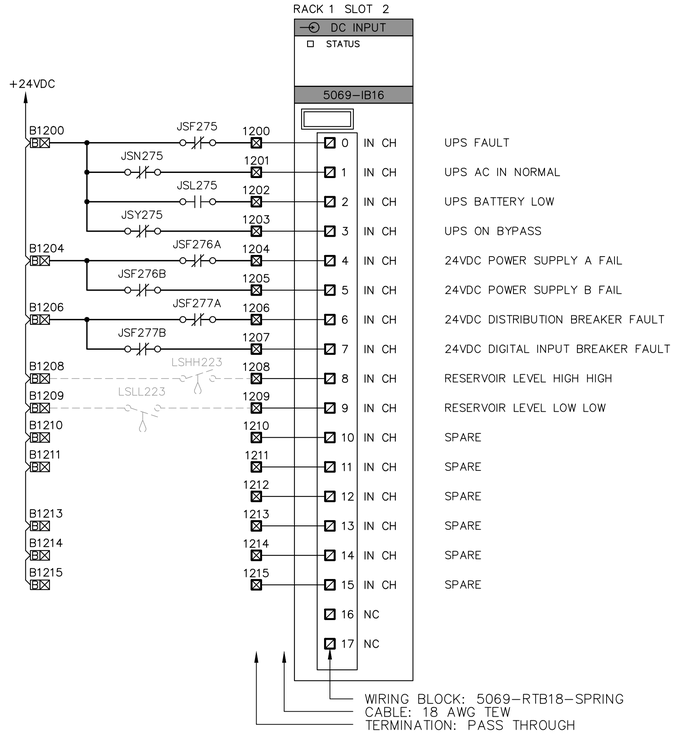
January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION PLC ANALOG INPUT MODULE 1

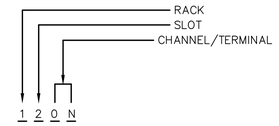
DESIGNED	G.B.P.	JOB	9794–003–00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E23.11



DI-01

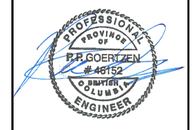
NOTES:

1. FOR INFORMATION REGARDING GENERAL NOTES, ABBREVIATIONS, AND SYMBOLS, REFER TO THE LEGEND DRAWINGS.
2. REFER TO BILL OF MATERIALS AND LABEL SCHEDULE DRAWING.
3. REFER TO CONTROL PANEL ENCLOSURE DRAWING FOR TERMINAL STRIP LOCATION.
4. CIRCUIT BREAKERS 1AMP UNLESS NOTED OTHERWISE.



THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

1	21-01-22	FOR TENDER
ISSUE	YY-MM-DD	REVISION



January 22, 2021

MPE Engineering Ltd.

REGIONAL DISTRICT OF NANAIMO

WHISKEY CREEK PHASE 1A
ELECTRICAL
PUMP STATION PLC DIGITAL INPUT MODULE 1

DESIGNED	G.B.P.	JOB	9794-003-00
DRAWN	Y.F.S.	SCALE	NTS
DATE	JANUARY 2021	DRAWING	E23.13